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A TAXONOMY OF OFFICE ACTIVITIES FOR BUSINESS AND OFFICE EDUCATION. INTERIM REPORT. RESEARCH 12.

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A TAXONOMY IS AN ORDERLY CLASSIFICATION SYSTEM THAT PROVIDES FOR AN IDENTIFICATION OF RELATIONSHIPS. A TAXONOMY OF OFFICE ACTIVITIES FOR BUSINESS AND OFFICE EDUCATION WAS DEVELOPED TO PROVIDE SYSTEMATIC GUIDANCE FOR OBSERVING AND ANALYZING OFFICE ACTIVITIES, A COMMON LANGUAGE FOR DESCRIBING OFFICE ACTIVITIES, A BASIS FOR CONSOLIDATING DATA FROM MANY LOCATIONS AND OCCUPATIONS, AND A BASIS FOR WRITING PERFORMANCE GOALS. INFORMATION FROM PREVIOUS RESEARCH, FROM SECONDARY SOURCES, AND FROM IDEAS OF MANY EDUCATORS AND EXPERTS IN BUSINESS AND IN OFFICE ADMINISTRATION WAS USED IN ITS DEVELOPMENT. IT CONSISTS OF A LIST OF APPROXIMATELY 800 ACTION VERBS ORGANIZED IN THREE DOMAINS--OPERATING, INTERACTING, AND MANAGING--EACH OF WHICH HAS PRIMARY AND SECONDARY DIVISIONS. EACH VERB IS DEFINED AND USED TO ILLUSTRATE A SAMPLE TASK DESCRIPTION. POSITION PAPERS USED IN DEVELOPING THE TAXONOMY ARE PRESENTED--(1) NORMAN KALLAUS DESCRIBES THE RELATIONSHIPS OF MAN, MACHINE, AND WORK AND THE IMPACT OF NEW HARDWARE ON ALL THREE, (2) W.M. CARRITHERS DISCUSSES THE RELATIONSHIP OF DEVELOPMENTS IN HARDWARE TO DEVELOPMENTS IN SOFTWARE, AND (3) IRENE PLACE PRESENTS A DETAILED PROCEDURE FOR DEVELOPING AND STABILIZING A CLASSIFICATION SCHEME FOR ANALYZING ACTIVITIES OF OFFICE JOBS. A DEFINITION OF TERMS, AN INDEX OF VERBS FOR THE TAXONOMY, AND A BIBLIOGRAPHY ARE INCLUDED. THIS DOCUMENT IS AVAILABE FOR $2.75 FROM THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION, THE OHIO STATE UNIVERSITY, 980 KINNEAR ROAD, COLUMBUS OHIO 43212. (PS)

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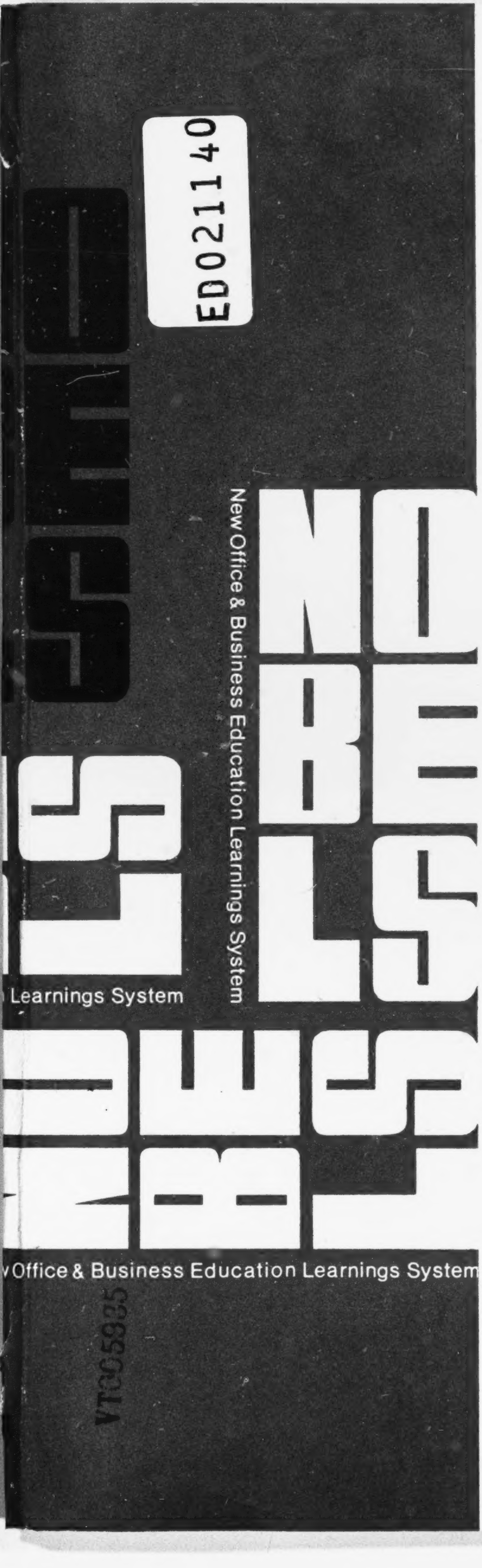
NOBELS
New Office & Business Education Learnings System
Learnings System
Office & Business Education Learnings System

VT005835

a taxonomy of office activities for business and office education

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AND TECHNICAL EDUCATION

THE OHIO STATE UNIVERSITY
980 Kinnear Rd, Columbus Ohio, 43212

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RESEARCH 12

Interim Report
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A TAXONOMY OF OFFICE ACTIVITIES FOR BUSINESS AND OFFICE EDUCATION

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Office of Education, Bureau of Research

PREFACE

Business and office educators have long recognized the need for a comprehensive method of analyzing office work. Efforts in the past, although helpful, have been sporadic and segmented. A unique approach to the analysis of office activities, in the form of a taxonomy, has been developed by the business and office education staff at The Center for Vocational and Technical Education.

This taxonomy provides for an orderly and systematic way of looking at office activities in the operating, interacting, and managing dimensions. Information gathered through this method of analysis can be used as a basis for the development of realistic performance goals.

The development of The Taxonomy of Office Activities for Business and Office Education was the final step in the Planning and Feasibility Study for the NOBELS (New Office and Business Education Learnings System) Project which will have as its major objective the development of performance goals for business and office education. The taxonomy will be used in later phases of the NOBELS Project for collection, organization, and analysis of data.

We are indebted to many individuals and organizations from the business, industrial and university communities for invaluable assistance in developing the Taxonomy. By participating constructively in conferences, and by providing consultation, ideas, prepared papers, critiques of our efforts, and opportunities to observe office operations, they have contributed substantially to the results reported here.

Recognition is due the following Center staff members: Harry Huffman, specialist in business and office education; Mary Margaret Brady, visiting professor from Southern Illinois University, Edwardsville; Marla Peterson and Annell Lacy, research associates, for their work in developing the taxonomy.

Robert E. Taylor
Director, The Center

SUMMARY

This report describes a taxonomy of office activities for business and office education developed to provide:

1. *systematic guidance for the observation and analysis of office activities,*
2. *a common language for describing office activities,*
3. *a basis for consolidating data from many locations and occupations, and*
4. *a basis for writing performance goals.*

The Taxonomy will be used to identify, describe, and analyze office activities relating to information processing, task management, and employee interactions.

Development of the Taxonomy began with a review of secondary sources of information about office activities. The data collected through this review were used to develop and revise several trial taxonomies. The trial versions and their conceptual bases were developed further and reviewed with assistance from a number of consultants and advisors who suggested several taxonomies and strategies and offered position papers on significant, relevant issues. The Taxonomy which emerged from this process of trial and revision was tested by using it to describe office activities observed in visits to several business firms. Finally, several juries reviewed the Taxonomy and the present version was prepared. The product of the study is a list of approximately 800 action verbs organized in three domains: operating, interacting, and managing, each of which has primary and secondary divisions. Each verb in the Taxonomy is defined and used to illustrate a sample task description. Ultimately, conditions under which each task is to be performed and the criteria of successful achievement will be added to each task description to develop prototype performance goals.

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A TAXONOMY OF OFFICE ACTIVITIES FOR BUSINESS AND OFFICE EDUCATION

I

BACKGROUND AND DEVELOPMENTAL PROCEDURES

THE PROBLEM

The office of today serves as an information processing center for management. The advent of office automation has created changes in information processing that have significant implications for the office worker. Many activities have been automated and new activities created which involve planning and decision making. While technological and scientific innovations have caused changes in the office, the basic instructional program intended to prepare persons for office occupations has remained virtually unchanged. New instruction is needed to prepare young people to meet current and emerging requirements of the office.

In recognition of this need for revision, a planning and feasibility study (8) was undertaken to explore the feasibility of a new, comprehensive, coherent, and timely curriculum for business and office occupations and to devise specific procedures and techniques for developing the curriculum. The study (8) concluded that development of a new curriculum was feasible and reported (7) a plan for NOBELS (New Office and Business Education Learnings System). This plan defines developmental procedures whereby performance goals and curricula would be derived by analysis of the performance requirements observed in current and emerging office activities.

The feasibility study also showed the need for a language for consistent, unambiguous descriptions of the activities observed and a conceptual framework to guide the observations. Consequently, development of a Taxonomy of Office Activities for Business and Office Education was begun during the planning study to provide this language and framework. The specific objectives, then, of the Taxonomy are as follows:

1. To provide systematic guidance for the observation and analysis of office activities. The behavior of office workers is complex with many facets. There is much more to be observed in even the simplest jobs than can be recorded or analyzed. Observation, recording, and analysis must be selective. It is essential, therefore, that a consistent basis for selection be used by all observers and analysts in all office situations. Further, the guide used by observers must be comprehensive so that not only the operations involved in performing office activities, but also the interactions and the task management that are required of office workers in performing office activities are not overlooked.

2. To provide a common language for describing office activities. The Taxonomy should provide a comprehensive and consistent language for describing observed office activities.

3. To provide a basis for consolidating data from many locations and occupations. Observations of activities will be recorded by many persons in many different offices in many diverse occupations. It is important that these records be capable of consolidation. That is, similar and identical activities must be identifiable wherever and by whomever observed if any single set of educational objectives is to be selected.

4. To provide data for writing performance goals. The Taxonomy should serve as a basis for identifying unambiguously the behavior expected of successful students of business and office occupations.

LIMITATIONS

The Taxonomy is a preliminary effort to develop a comprehensive and consistent means of analyzing office activities. It has not been evaluated thoroughly at this time. Small-scale efforts by The Center research staff have indicated that office activities can be recorded and analyzed quickly using the Taxonomy. However, since these researchers developed the Taxonomy, they were unusually familiar with it and it is not certain that others would be able to work with the Taxonomy so easily. Also, The Center staff has analyzed activities only in a limited number and variety of offices so far.

The Taxonomy was developed primarily through an "armchair" approach. The preliminary version presented here was developed using information from previous research, from secondary sources, and from ideas of many educators and experts in business and in office administration. The Taxonomy should be considered, at this time, an initial effort to develop a classification scheme for office activities using action verbs. It is presented in its preliminary state because the research staff recognizes the importance of the assistance that others can provide in refining, revising, and debugging.

RELATED TAXONOMIES

At the time the research was begun for the Taxonomy, the research staff did not know what kind of scheme would be most useful in classifying and analyzing office activities as an aid to the defining of performance goals. Therefore, other taxonomies and classification systems were examined first to determine whether any of them could be used for this purpose. The taxonomies and classification schemes that were reviewed fell primarily into two groups: schemes for classifying activities other than those of the office, and classifications of psychological processes involved in learning to perform all types of activities. None of the classification systems was found to meet the objectives established for this Taxonomy, but their methods and procedures and their analyses of subject areas provided ideas which were useful in this development.

The Taxonomy of Educational Objectives for each of the three domains, the cognitive domain (2), the affective domain (6), and the psychomotor domain (10) were prepared to provide clear definitions of general educational objectives. The categories in these domains can be used to describe the cognitive, affective, and psychomotor elements of office activities, but they do not provide a structure for discovering and classifying intact office activities. After office activities have been identified through the use of the proposed taxonomy, it may be possible to analyze them into their cognitive, affective, and psychomotor elements as an aid in selecting appropriate learning conditions and in devising effective measures of the achievement of performance goals.

Gagné (4) and Altman (1) developed hierarchial structures of behavioral capabilities in which each capability requires a unique set of learning conditions. They do not provide for the description of office tasks as complete units, which is needed in the present study, but they may prove helpful in later phases of the NOBELS project when learning conditions are being defined for the achievement of performance goals.

Openshaw and Cyphert (9) described a taxonomy of teachers classroom behavior. This taxonomy suggested ways to look at office activities, but did not provide a scheme for classifying observed office activities.

DEVELOPMENTAL PROCEDURES

The development of the Taxonomy began with a review of secondary sources of information about office activities. The data collected through this review were used to develop and revise several trial taxonomies. These trial versions and their conceptual bases were further developed and reviewed with assistance from a number of consultants and advisors who suggested several taxonomies and strategies and offered position papers on significant, relevant issues. The Taxonomy which emerged from this process of trial and revision then was tested by using it to describe office activities observed in visits to several business firms. Finally, several juries reviewed the Taxonomy and the present version was prepared. Each of these major procedural steps is described in more detail below.

Review of Secondary Sources Relating to Office Activities

Secondary sources were reviewed to identify the most frequently performed office functions and activities. Office activities, office functions, and ideas for classification schemes were recorded as a review was made of textbooks in business education, office procedures, filing, data processing, and information economics; professional journals in business education and office management; current literature such as Harvard Business Review, Fortune, Administrative Management, and Systems and Procedures; the Vocabulary of Records Management Terms prepared by the

Association of Records Executives and Administrators; and related research projects.

Meetings and Consultants

Through several meetings with educators and practitioners in the field of office management, ideas, suggestions, and theories were developed for the classification scheme of the Taxonomy.

1. The initial tentative classification scheme for office activities was developed by the research staff in six meetings for which Charles B. Hicks, professor of business organizations, served as consultant.

2. Harold Trimble, professor of mathematics education, served as consultant to discuss mathematical concepts which might be applied to the analysis of office activities. Particular attention was given to the use of set theory to show interrelatedness of office activities in developing the classification scheme.

3. The tentative classification scheme was reviewed by a group of business teacher educators and office supervisors in a meeting at the University of California at Los Angeles under the direction of Lawrence Erickson, professor of business education.

4. The classification scheme was reviewed in terms of office functions to determine whether it was broad enough to include office activities relating to all office functions within an organization. George R. Terry, professor of business administration, served as consultant in making this review.

5. Trends and developments in software (business information systems) that should be considered in developing the Taxonomy were discussed by a consortium in Chicago. Thomas R. Prince, professor of business administration, and executives in the Department of Equipment Research, Sears Roebuck and Company, served as consultants.

6. The effects which emerging hardware may have on office activities were examined by a consortium at The Center. See Appendix A for a report of this meeting.

Proposed Taxonomies

In order to establish alternative plans for developing the classification scheme for the Taxonomy, two consultants prepared suggested frameworks and one consultant outlined procedures for developing and stabilizing a taxonomy. Some of the ideas from these position papers were used in developing the Taxonomy.

E. Dana Gibson (5) developed a framework for a taxonomy on a conceptualization of the information processing function which includes operating functions, actuating functions, and evaluating functions. A framework for developing a taxonomy according to job titles was proposed by Kenneth Zimmer (11). Irene Place presented a detailed procedure to follow in developing and stabilizing a classification scheme for analyzing activities of office jobs. Place's paper is reproduced in Chapter VI.

Two position papers on the emergent office were commissioned; one on emerging hardware and one on emerging software. The purpose of these position papers, presented in Chapters IV and V, was to identify implications which emerging hardware and software might have for the classification scheme. A paper which describes the relationships of man, machine, and work and the impact which new hardware will have on all three was prepared by Norman Kallaus and is presented in Chapter IV. W. M. Carrithers discussed the relationship of developments in hardware to developments in software in his paper (Chapter V).

Office Visits

The Center research staff made office visits to obtain first-hand data concerning office activities. During the first office visits, specific attention was given to purchasing departments and to determination of similarities and differences among such departments in various organizations. Both computer and non-computer offices were visited. Purchasing departments were analyzed in the following organizations:

1. The Ohio State University, Columbus, Ohio

2. Shoe Corporation of America, Columbus, Ohio

3. The F & R Lazarus and Co., Columbus, Ohio

As the researchers observed each of these departments. activities were recorded and later analyzed to determine ways of classifying the data.

Activities were found to be comparable in computer and non-computer offices although the tasks individuals performed in completing an activity varied greatly among offices.

In addition to the visits to purchasing departments, other departments were observed and office activities were recorded in the following organizations:

1. Motorists Mutual Insurance Company, Columbus, Ohio
2. Western Electric, Columbus, Ohio
3. BancOhio Corporation, Columbus, Ohio
4. Millers Mutual Insurance Company, Alton, Illinois
5. Olin Mathieson Chemical Corporation, East Alton, Illinois
6. Shell Oil Company, Wood River, Illinois

The accuracy and completeness with which purchasing activities were recorded, analyzed and in a tentatively classified were checked in a meeting with a group of New York purchasing agents.

Juries

After the Taxonomy was developed, juries were used to evaluate and make suggestions for revisions of the Taxonomy. A jury of six research associates at The Center studied the Taxonomy and made recommendations for revisions of the Taxonomy. Inez Ray Wells, Elfreda Rusher, and Bobbye Joan Wilson, professors of business education, each evaluated the Taxonomy and made suggestions for changes.

The names of all persons who served as consultants, participated in meetings, served on juries, and prepared papers are listed in Appendix D.

II

STRUCTURE OF THE TAXONOMY OF OFFICE ACTIVITIES

A VOCABULARY OF VERBS

The Taxonomy of Office Activities was developed within a framework of action verbs. Edling states that the verb in a sentence that describes behavior is the crucial element in preparing a behavioral objective (3). Since the taxonomy is to be used for the writing of performance goals, the verbs will provide for the action statements needed in the goals.

With a properly selected list of verbs, an all-inclusive list of office tasks and activities can be developed by adding nouns, adjectives, and phrases to the verbs. One verb may be used to describe many tasks by simply changing the descriptors attached. Thus, a simple framework of verbs will serve as a medium for describing all office tasks and activities.

Another reason for the use of verbs as the basis of the taxonomy is their relative constancy in meaning. Verbs represent fundamental processes that will remain unchanged although procedures in their performance may change. For example, invoices are extended whether the process is performed on a calculator or a computer.

Thus a vocabulary of verbs provides both an action and a constant base for describing office tasks and activities.

COLLECTION OF VERBS

The first group of verbs was obtained from the list of office activities that had been recorded during the review of secondary sources and office visits. Each action verb was recorded on an index card and the cards were then alphabetized.

In order to extend the list of verbs and to obtain a more comprehensive group of verbs, The Original Roget's Thesaurus of English Words and Phrases, completely revised and modernized by Robert A. Dutch; Modern Guide to Synonyms, edited by S. I. Hayakawa; and A Dictionary of Contemporary American Usage, by Bergen and Cornelia Evans were searched to secure additional verbs that might be descriptive of office tasks and activities. These verbs were also placed on cards and alphabetized. Meanings and concepts of each verb that had been recorded on an index card were determined through the use of the reference books listed above. Then, the researchers each took a given part of the alphabet and went through that part of the alphabet in dictionaries to determine whether or not additional verbs might be added to the already lengthy group of verbs. All additional verbs were then recorded on index cards and alphabetized with the previous group of verbs. The final group of verbs totaled approximately 2,000 by the time the review of secondary sources was completed.

VERBS IN THE PRIMARY DIVISIONS OF THE OPERATING DOMAIN

The verbs were then studied in an effort to uncover sets, patterns, and classes into which verbs might be grouped. Verbs which revolved around the processing of data were the first to emerge. These verbs included the usual data processing operations of calculating, sorting, recording, etc. However, verbs like selecting, arranging, and modifying, which traditionally have not been associated with the data processing cycle, seemed to also cluster in this area. After intensive study and analysis, 13 verbs, selected because of their importance to the processing of data and because of their clear distinctions in meaning, were designated as primary divisions of a domain labeled "Operating." Other verbs, descriptive of the 13 operations, were placed in secondary divisions within the 13 primary divisions and will be discussed later.

VERBS IN THE PRIMARY DIVISIONS OF THE INTERACTING DOMAIN

The remaining verbs seemed to cluster into oral communicating, assisting, and administering categories. Considerable difficulty was experienced in determining whether oral communicating verbs should be placed in the Operating Domain or whether they should be placed in a domain that reflected interpersonal relationships. Those verbs involving written communication had already fallen naturally into the composing, recording, and transmitting divisions of the Operating Domain. The oral communicating verbs, along with the assisting verbs, contained interpersonal elements and so were not placed in the Operating Domain.

The assisting verbs fell into two categories--those verbs associated with helping others and those verbs associated with the manner in which the worker copes with the stress and strain of office work. Communicating, assisting and coping with problems encountered in the office involved interaction with people and the work environment. Therefore, the second domain, Interacting, was developed. Included in this domain are the three primary divisions, communicating (oral), assisting, and coping. As in the Operating Domain, other verbs were placed in secondary divisions within each of the primary divisions.

VERBS IN THE PRIMARY DIVISIONS OF THE MANAGING DOMAIN

Eventually the administering verbs were placed in a third domain--Managing--because Managing seemed to be a more descriptive category for classifying office work than administering. Certainly, the performance of office activities involves some elements of managing at the office-worker level. These managing activities may be grouped for the office worker, as for other levels of management, under the headings of planning, organizing, actuating, and controlling. While these same activities are performed at varying levels of management, from top level to the office-worker level, they are an integral and necessary part of an activity at any level. Therefore, the traditional management categories of planning, organizing, actuating, and controlling became the four primary divisions of the Managing

Domain. Verbs placed in secondary divisions under these primary divisions will be considered later.

VERBS IN THE SECONDARY DIVISIONS OF THE DOMAINS

After the three domains and the primary divisions of each of the domains had been determined, secondary divisions were established for each of the primary divisions to indicate distinctive ways in which the action of the primary verb might be carried out. When several verbs were so closely related that for educational purposes it seemed unnecessary to create another division, the verb most appropriate for describing office work was selected as the secondary-division verb. The closely related verbs were put in parentheses beside the secondary-division verbs. Each secondary-division verb was defined and a hypothetical office task that used the verb to describe the action performed was written as an example. Each secondary division is concluded by the use of a category classified as "other." This category creates an open-ended taxonomy to which verbs may be added if necessary.

Examples in the following sections have been selected from each domain to illustrate how the secondary divisions were established and how they form a part of the primary division.

Operating Domain--In the Operating Domain one of the primary divisions is that of Collecting. Secondary divisions under Collecting are represented by such verbs as borrow, order, scan, search, and select. Each of these verbs carries a special connotation regarding the manner in which data may be collected.

In the Calculating division, the secondary-division verb, Compute, covers the four basic mathematical operations of adding, multiplying, subtracting, and dividing. Other divisions in Calculating provide for frequent and specific mathematical operations.

In the Recording division, secondary-division verbs include Copy, Duplicate, Transcribe, and Write. Typewrite, as a division, is not included because the Taxonomy emphasizes operations such as copy and compose rather than the psychomotor skills involved in an activity such as typewrite. Provision has been made for the motor skills involved in the operation of a typewriter, a keypunch, a calculator, or an adding machine through such operational verbs as compose, copy, transcribe, and compute.

Similar examples could be given for each of the 13 categories in the Operating Domain.

Interacting Domain--In the Interacting Domain under the primary division of Communicating, the secondary-division verbs describe various means of oral communication. These verbs have been arranged alphabetically in the taxonomy for convenience; however, they can be grouped into categories of "asking for information," "giving of information," "receiving of information," and "discussing information." They include such secondary verbs as question, inquire; quote, describe; listen; debate and persuade.

Under the primary division of Assisting, the secondary verbs indicate the various ways in which assistance may be given--through instruction such as train and inform; by building morale such as encourage and placate; or by special ways of assisting such as escort and orient.

Under the primary divisions of Coping, the secondary verbs describe various ways in which a worker may cope with the stress and strain which he encounters in carrying out his activities. He may take positive action to overcome such as adapt, compromise, cooperate, and improvise. Instead of positive action he may decide to take negative action to overcome in which case he may bluff, boast, rationalize, or verbalize. The worker may take action to escape the situation as circumvent or withdraw, or may merely endure the situation and take no action at all such as refrain and disregard.

Managing Domain--In the Managing Domain, verbs in the secondary divisions indicate how the work may be planned, organized, actuated, and controlled. At the initiation of the activity and throughout the performance of the tasks, the worker plans and organizes. In planning he may design, classify, or forecast material needs. To organize he may schedule and allocate, centralize the work in one location, or equip his work station with necessary materials and supplies. To actuate the activity, the worker may adjust his time schedule, initiate new procedures, or motivate his peers to accomplish the task effectively. To control, the worker may approve or disapprove the quality of the work; upon completion he may evaluate the performance.

STRUCTURE OF THE DOMAINS

As described above, each of the three domains includes primary- and secondary-division verbs. When the Taxonomy is used to group office tasks, each task will be placed under the secondary-division verb which is descriptive of the action involved in the task.

The hypothetical office tasks which have been included in the Taxonomy are illustrative of the manner in which office tasks may be placed under the various secondary division verbs. The overall structure of the Taxonomy takes the form shown below.

(a)
I - OPERATING DOMAIN

(b) (c) (d)
1.0 ARRANGE: putting into an order or system

(e) (f) (g)
1.01 collate (integrate, merge)

(h)
to put together in a predetermined order

(i)
Given multiple copies of pages for a report,
the worker collates them.

. . . .

(j)
1.06 other

KEY

a. Domain
b. Primary-Division Number
c. Primary-Division Verb
d. Primary-Division Verb Definition
e. Secondary-Division Number
f. Secondary-Division Verb
g. Related Verbs (Secondary Division)
h. Secondary-Division Verb Definition
i. Secondary-Division Verb Task Example
j. Provision for adding Secondary Division Verbs

OVERLAPPING DOMAINS WHICH MAY BE PRESENT IN AN OFFICE ACTIVITY

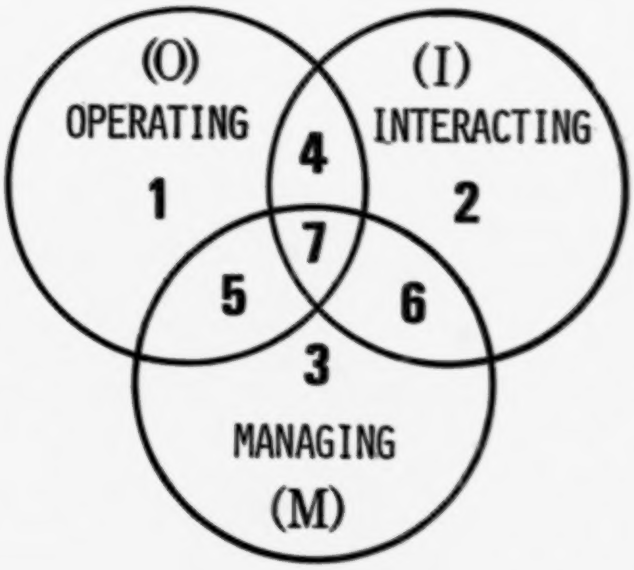


FIGURE 1

1. Operating (O)
2. Interacting (I)
3. Managing (M)
4. Operating-Interacting (OI)
5. Operating-Managing (OM)
6. Interacting-Managing (IM)
7. Operating-Interacting-Managing (OIM)

Figure 1 illustrates the seven ways which the three domains may occur in an office activity. This figure clearly shows how the domains may overlap but it in no way indicates a hierarchy of performance difficulty. Under some conditions one activity involving only the Managing Domain (No. 3) might be considerably more difficult than another activity which includes all three domains (No. 7). For example, one activity might consist of the establishment of the major categories for a records management system. This activity involves only classifying which occurs under the planning division of the Managing Domain.

Another activity might be the coding, sorting, and filing of correspondence. This activity would be broken down into three separate tasks any one of which is simple. Thus while three operations are involved, the performance of the activities is much simpler than the one activity of classifying.

Each domain contains its own distinct type of performance difficulty dependent upon the activity. Until further research is conducted on the relationship of the domains, the Taxonomy of Office Activities for Business and Office Education, can, at best, only: 1) group activities by categories within domains, and 2) establish the number of domains involved in the performance of an activity. Yet, this is a step forward. In the past, educational programs have been based upon job-analysis techniques which were concerned primarily with job-skill activities. As a result, job skills, which are just one aspect of the Operating Domain, have been emphasized either to the exclusion of or in isolation from the other aspects of the Operating Domain and the Interacting and Managing Domains. As shown in Figure 1, the Taxonomy of Office Activities provides the framework for determining which office activities are isolated in one domain and which activities are influenced by a combination of domains.

JUSTIFICATION FOR USE OF THE TERM, TAXONOMY

In the construction of a taxonomy, some logical or "real" order must be present among the domains and divisions. Domains and divisions in a taxonomy cannot arbitrarily be assigned as in a classification system. In the Taxonomy of Office Activities, three domains, Operating, Managing, and Interacting, are established around a natural sequence based on the processing of data. These domains of the Taxonomy provide for an orderly classification of office activities. The rationale for the domains is based on the thesis that most office tasks (office tasks make up office activities) occur in an innate order of input, processing, and output of data.

The operations involved in the processing and output of data in the tasks constitute the activity. The operations for each activity occur in a natural and logical sequence--the gathering of needed data, the processing of the data, and the output of information. These orderly operations provide for the inclusion of the Operating Domain in the Taxonomy of Office Activities.

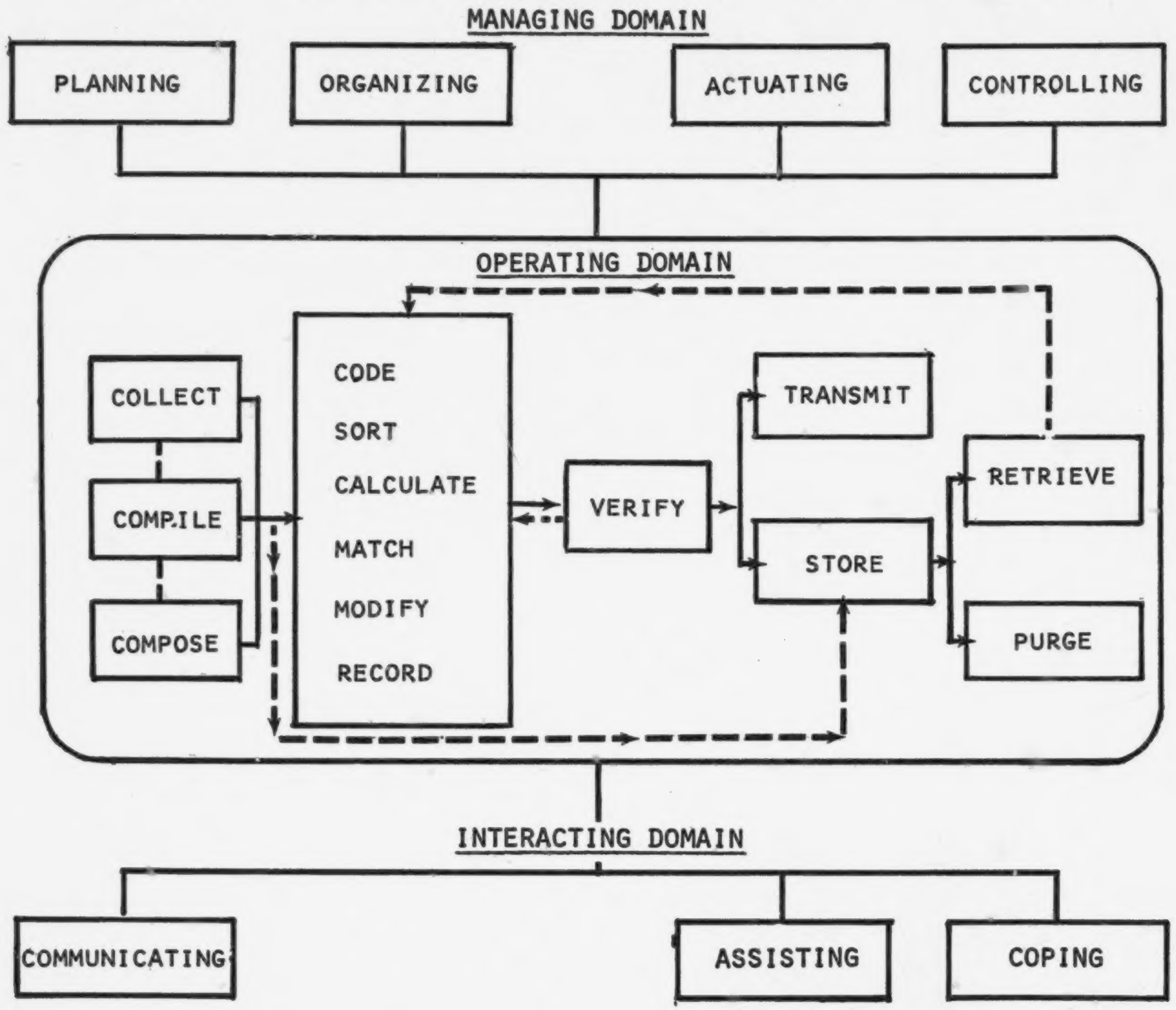
Throughout the performance of activities, varying degrees of interacting will occur with the personnel involved and with the office environment. The Interacting Domain is included in the Taxonomy in order to provide a way to classify the role of the individual or group in relation to other personnel and the working environment in which his performance takes place.

The initiation of an activity (input) may involve planning and organizing as well as the carrying out of operations. As the activity is processed and completed, the other elements of the Managing Domain appear--actuating and controlling. The rationale for the Managing Domain is based on the premise that in varying degrees, activities involve elements of these four phases of management.

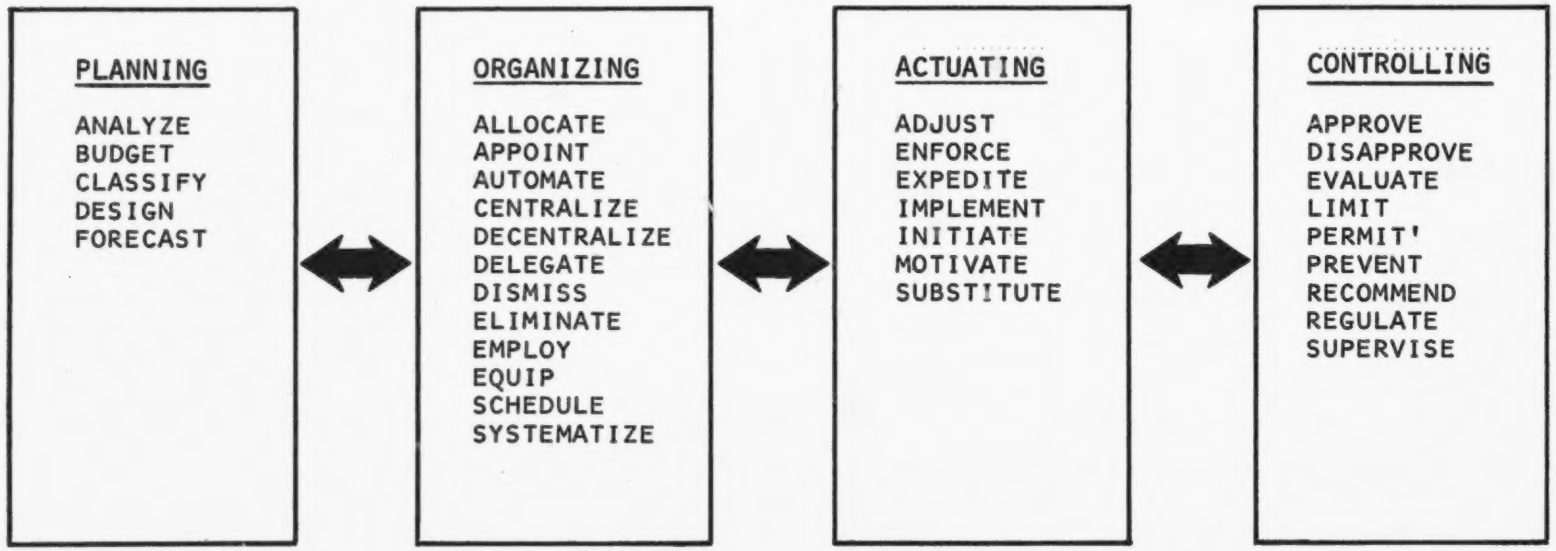
While the three domains, Operating, Interacting, and Managing do not occur in any sequential order for all office activities, there is an ordered occurrence of the three domains within any one activity.

The chart on pages 20-23 illustrates how the Managing and Interacting Domains can permeate the Operating Domain at any stage of the input-processing-output cycle.

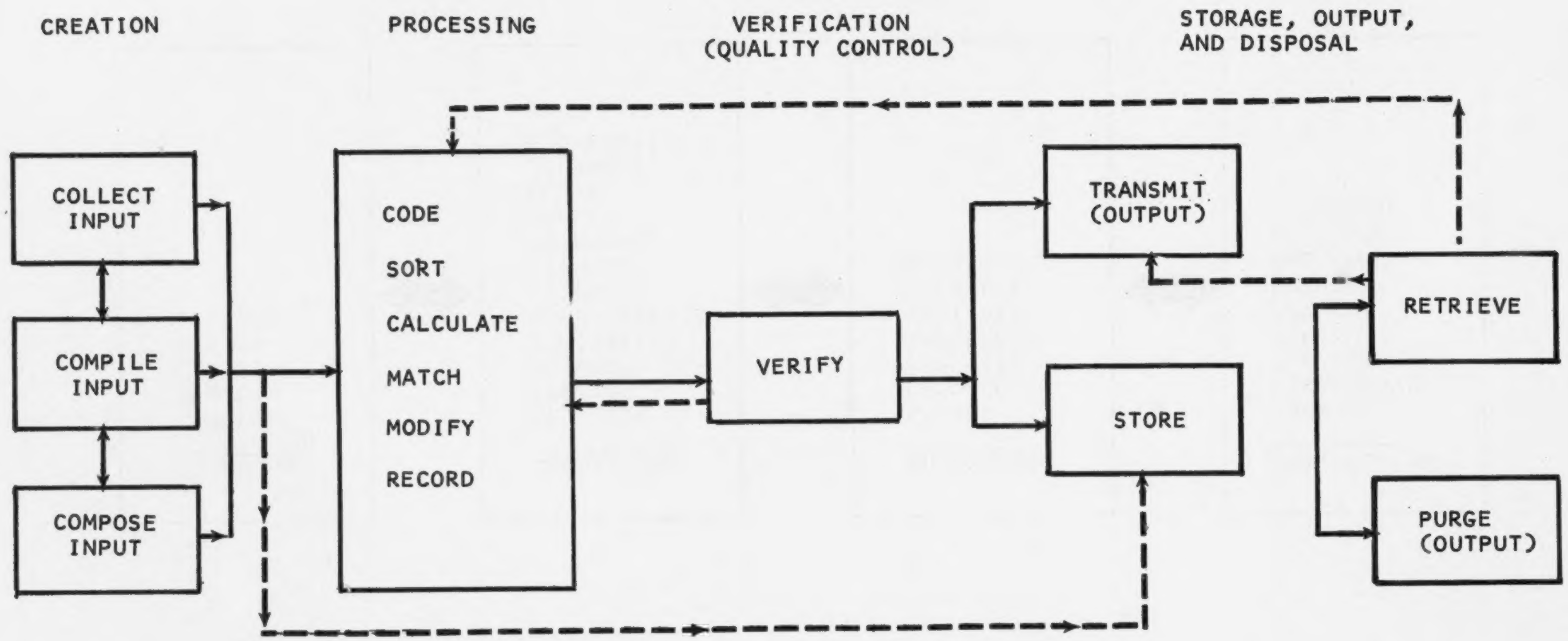
A TAXONOMY OF OFFICE ACTIVITIES FOR BUSINESS AND OFFICE EDUCATION


MANAGING DOMAIN
PLANNING
ORGANIZING
ACTUATING
CONTROLLING
OPERATING DOMAIN
COLLECT
COMPILE
COMPOSE
CODE
SORT
CALCULATE
MATCH
MODIFY
RECORD
VERIFY
TRANSMIT
STORE
RETRIEVE
PURGE
INTERACTING DOMAIN
COMMUNICATING
ASSISTING
COPING

MANAGING DOMAIN


PLANNING
ANALYZE
BUDGET
CLASSIFY
DESIGN
FORECAST
ORGANIZING
ALLOCATE
APPOINT
AUTOMATE
CENTRALIZE
DECENTRALIZE
DELEGATE
DISMISS
ELIMINATE
EMPLOY
EQUIP
SCHEDULE
SYSTEMATIZE
ACTUATING
ADJUST
ENFORCE
EXPEDITE
IMPLEMENT
INITIATE
MOTIVATE
SUBSTITUTE
CONTROLLING
APPROVE
DISAPPROVE
EVALUATE
LIMIT
PERMIT'
PREVENT
RECOMMEND
REGULATE
SUPERVISE

OPERATING DOMAIN *


CREATION
PROCESSING
VERIFICATION (QUALITY CONTROL)
STORAGE, OUTPUT, AND DISPOSAL
COLLECT INPUT
COMPILE INPUT
COMPOSE INPUT
CODE
SORT
CALCULATE
MATCH
MODIFY
RECORD
VERIFY
TRANSMIT (OUTPUT)
STORE
RETRIEVE
PURGE (OUTPUT)

*SELECTED PRIMARY AND SECONDARY DIVISION VERBS HAVE BEEN USED IN THIS ILLUSTRATION.

INTERACTING DOMAIN

COMMUNICATING

ASKING FOR INFORMATION

- canvass
- demand
- elicit
- inquire
- invite
- page
- question
- request
- think

GIVING INFORMATION

- affirm
- answer
- describe
- detail
- emphasize
- explain
- express
- quote
- repeat
- reveal
- suggest
- summarize

RECEIVING INFORMATION

TALKING OVER INFORMATION

- consult
- debate
- discuss
- negotiate
- persuade

↔

ASSISTING

MORALE BUILDING

- alert
- encourage
- intercede
- placate
- welcome

GUIDING OTHERS

- escort
- orient

TRAINING OTHERS

- advise
- inform
- instruct
- remind
- show

HELPING OTHERS

- aid

↔

COPING

POSITIVE ACTIONS TO OVERCOME

- accept
- adapt
- admit
- apologize
- charm
- obey
- socialize
- coax
- compensate
- compromise
- cooperate
- empathize
- persevere
- yield
- excel
- forgive
- hint
- improvise
- innovate
- respect

NEGATIVE ACTIONS TO OVERCOME

- bluff
- boast
- compete
- rationalize
- refuse
- verbalize

ACTIONS TO ESCAPE

- avoid
- circumvent
- withdraw

INACTION

- disregard
- endure
- refrain

III

A TAXONOMY OF OFFICE ACTIVITIES

I - OPERATING DOMAIN

1.0	Arranging:	putting into an order or system
2.0	Calculating:	computing new data from present data by some mathematical process or combination of processes
3.0	Collecting:	securing data, supplies, or equipment
4.0	Comparing:	examining in order to determine similarities and differences
5.0	Composing:	creating and developing written information
6.0	Indexing:	determining and indicating categories to which materials may be assigned
7.0	Manipulating:	performing simple manual or mechanical operations
8.0	Modifying:	making changes
9.0	Purging:	destroying or eliminating

10.0	Recording:	placing data or information on paper, film, tape, or other media
11.0	Storing:	setting aside for future use
12.0	Transmitting:	giving out or sending out
13.0	Verifying:	determining the accuracy or inaccuracy of data

II - INTERACTING DOMAIN

1.0	Communicating:	oral means of requesting, giving, receiving, or discussing information
2.0	Assisting:	morale building, guiding, and training-type activities performed by office workers
3.0	Coping:	using strategies to deal with threat: positive action to overcome; negative action to overcome; action to escape; no action

III - MANAGING DOMAIN

1.0	Planning:	mental determining of a course of action
2.0	Organizing:	establishing the work environment
3.0	Actuating:	stimulating and maintaining of performance and effecting corrective measures
4.0	Controlling:	evaluating work performed and the determination and recommendation of corrective measures based on feedback

1.0 ARRANGING: putting into an order or system

1.01 batch

to group similar materials for processing

Given checks from policy holders, the clerk batches them for processing on the computer.

1.02 collate (integrate, merge)

to put together in a predetermined order

Given multiple copies of pages for a report, the worker collates them.

1.03 compile (assemble, combine, consolidate)

to assemble and put in a logical order

Given a request for information on copying processes, the worker compiles the information from various brochures on the subject.

1.04 sort (separate)

to separate into established categories

Given the completed case histories on a number of clients, the clerk sorts them into alphabetical order.

1.05 rank (order)

to place data in order by degrees according to some selected characteristics

Given price quotations from ten companies on an item of merchandise, the worker ranks the quotations in descending order according to prices quoted.

1.06 other

2.0 CALCULATING: computing new data from present data by some mathematical process or combination of processes

2.01 accrue (accumulate)

to accumulate periodically

Given the task of preparing a financial statement, the machine operator accrues interest due on bonds payable.

2.02 average

to find the arithmetic mean

Given the total sales figure and total number of customers per department, the machine operator averages to find the sales per customer.

2.03 balance

to compute the difference between two amounts, usually debits and credits, and arrange or prove that the sum of the two amounts is equal

Given the responsibility for closing the books, the clerk balances the accounts.

2.04 compound

to add to

Given a long-term investment, the clerk compounds the quarterly interest.

2.05 compute

to reach a solution by the use of mathematical processes

Given the job of preparing the payroll, the clerk computes the number of hours worked by each employee. (This is the general term if none of the others are applicable.)

2.06 count (enumerate)

to determine the total number of units involved

Given the need to inventory office supplies, the clerk counts the number of office supplies in each category.

2.07 cross-balance

to add both vertically and horizontally to arrive at a single total

Given a petty cash analysis sheet, the machine operator cross-balances as a check on accuracy.

2.08 cross-foot

to add horizontally

Given a daily sales figure by commodity, the operator cross foots to determine total sales for the day.

2.09 depreciate (amortize)

to lower the amount of

Given the need for knowing the trade-in values of a typewriter, the clerk depreciates the cost of a straight-line basis.

2.10 determine percents (percentage, rate)

to express the parts of a whole in terms of hundredths

Given the total sales for the current month and the past month, the operator determines the percent of increase or decrease.

2.0 CALCULATING

2.11 determine ratios

to determine the relation between two similar magnitudes in respect to the number of time the first contains the second

Given the ages of employees, the clerk determines that the ratio of workers under 25 and over 25 is 2 : 1.

2.12 discount

to make a deduction from

Given a number of monies, the clerk discounts them to determine the net amount

2.13 estimate (approximate)

to determine roughly an amount

Given percentages to calculate, the clerk estimates the answers.

2.14 extend

to multiply two or more factors in order to abtain a total, usually associated with unit cost and price

Given a purchase invoice to compute, the operator extends each item by multiplying the unit times the price.

2.15 measure

to ascertain the dimensions, capacity, or amount of

Given an area for a working space, the clerk measures it to determine the number of square feet available.

2.16 price (cost, mark down, mark up)

to establish monetary value

Given the cost and the percent of profit to be made, the clerk prices each item.

2.17 prorate

to distribute a total amount proportionately on some predetermined basis

Given the profit for a year, the operator prorates it to the stockholders on the basis of their investments.

2.18 total (foot, sum)

to obtain the sum of

Given checks for deposit, the clerk totals them.

2.19 other

3.0 COLLECTING: securing data, supplies, or equipment

3.01 borrow

to get from another with the intent of returning

Given a stack of brochures to process for mailing, the worker borrows a mailing list from the advertising department.

3.02 gather (accumulate, amass, assemble)

to bring together from more than one source

Given the job of preparing a consolidated sales report, the worker gathers the sales figures from each department.

3.03 obtain (acquire, gain, procure, secure)

to get possession of

Given the authority to make a purchase, the clerk obtains a purchase order number from the accountant.

3.04 order (requisition)

to issue a request for

Given the task of maintaining the supply cabinets, the worker orders supplies as needed.

3.05 preview

to make a preliminary survey for collecting information

Given the incoming daily correspondence, the secretary previews it and pulls out all materials containing comments about a new product.

3.06 retrieve (reacquire, recover, regain, repossess)

to acquire again

Given a request for information concerning an inactive account, the clerk retrieves the records from the inactive file.

3.07 scan

to glance over in order to secure pertinent data

Given the daily newspapers from cities in the state, the worker scans them to collect all articles pertaining to a new product.

3.08 search (hunt, investigate, look for, probe, seek)

to look for data

Given a request to order calendar refills, the worker searches supply catalogs to find the proper order number.

3.09 select (choose, discriminate, pick, screen)

to choose from a number of things available

Given a legal document to prepare, the worker selects the best type of carbon paper from the available supply.

3.10 other

4.0 COMPARING: examining in order to determine similarities and differences

4.01 associate

to bring together in any of various ways in order to discover or establish relationships

Given two phone calls with questions about information that should have been included in an announcement, the worker associates the two calls and upon investigation discovers that the second page of some of the announcements was missing.

4.02 distinguish (differentiate, discriminate)

to determine distinctions by perceiving and evaluating differences

Given copies made on several different copiers, the worker distinguishes those made by xerography by the fact that they were the only ones on untreated paper.

4.03 match

to put together according to equal or harmonizing attributes

Given a listing of figures from the computer and an adding machine tape, the worker matches the totals on the computer listing with those on the adding machine tape.

4.04 other

5.0 COMPOSING: creating and developing written information

5.01 annotate

to make critical or explanatory notes

Given a justification for the purchase of new equipment, the department head annotates it with pertinent information.

5.02 design (devise, draw, illustrate, invent, lay out, originate, sketch)

to devise for a specific function

Given the need for simplifying the requisitioning of office supplies, the supplies clerk designs a form for ordering supplies.

5.03 document (support)

to provide factual support for

Given an article written by the boss, the secretary documents it with facts from the company's annual report.

5.04 draft

to make a preliminary or tentative version of

Given a request to update the office manual, the secretary drafts the needed revisions.

5.05 edit (revise, rewrite)

to change by deleting or rearranging

Given the rough draft of a report, the secretary edits it in order to fit it into a prescribed format.

5.06 outline

to prepare a point by point list of the principal parts or features

Given a need for preparing a budget, the secretary outlines the steps involved.

5.07 paraphrase (reword)

to give the same meaning in a different form by restating

Given a technical report by the head of the data processing department on a new application for the computer, the programmer paraphrases the report for the vice presidents.

5.08 summarize (abridge, abstract, condense, digest, recapitulate)

to give a short description of without loss of original meaning

Given a meeting of the board of directors, the secretary summarizes the discussion.

5.09 write

to draw up in written form

Given a request for information about a new product, the secretary writes a letter explaining that it is not yet on the market.

5.10 other

6.0 INDEXING: determining and indicating categories to which materials may be assigned

6.01 code

to indicate by symbols or words the category to which materials have been assigned

Given the task of preparing material for filing, the clerk codes the day's correspondence.

6.02 cross-reference

to prepare a means for referring to a document by a subject, name, or number other than that under which the document is filed

Given correspondence from a company with a compound name such as Read, Alexander, & Fulton, Inc., the office worker cross references the correspondence under Alexander and under Fulton.

6.03 decode (decipher, translate)

to convert from code to ordinary language

Given a computer program written in machine language, the junior programmer decodes the program so that the deparment manager can make revisions in the program.

6.04 encode

to transfer one system of communication to another

Given a magnetic ink character reader-sorter for sorting checks by number, the worker encodes the amounts on checks on an encoder.

6.0 INDEXING

6.05 label

to place suitable marks or tape to items to identify contents

Given the task of transferring materials to storage, the worker labels each box to indicate its contents.

6.06 other

7.0 MANIPULATING: performing simple manual or mechanical operations

7.01 brush

to apply with a stroking action

Given some errors to correct on a stencil, the typist brushes on correction fluid.

7.02 clean (brush, dust, polish, scrub, shine, sweep, tidy, wipe)

to rid of dirt or extraneous matter

Given a copying machine, the secretary cleans the plastic belt.

7.03 cut (clip, shred, split)

to divide into pieces with an edged tool or shredder

Given a stencil with a paragraph that should be removed, the typist cuts out the paragraph with a razor blade.

7.04 erase (cross out, eradicate, scratch out)

to remove visible marks

Given a manuscript with typographical errors, the typist erases them.

7.05 fasten (affix, attach, bind, cement, glue, paste, pin, staple)

to put together

Given a quarterly report, the secretary fastens a routing sheet to the report.

7.06 feed

to move into a machine or opening

Given a stack of cards, the mimeograph operator feeds the cards into the machine by hand.

7.07 fix (patch, piece, touch up)

to set in order

Given a torn stencil, the typist fixes it by cementing a strip of stencil over the tear.

7.08 fold

to lay one part over another

Given an outgoing letter, the secretary folds it for insertion in an envelope.

7.09 ink

to supply with ink

Given a duplicating job to be done in colors, the operator inks the machine for the first run.

7.10 laminate

to unite layers of materials

Given a table which is to be used frequently, the secretary laminates it.

7.11 load (fill)

to supply with a full complement of

Given a duplicating job the operator loads the duplicator with paper.

7.12 lock

to make secure by means of a lock

Given a cabinet of keys, the receptionist locks it after issuing a key.

7.13 numbering

to assign a number to

Given a set of tickets for a conference, the secretary numbers them.

7.14 open (unfold)

to unfold or make an opening in

Given a stack of letters, the clerk opens them with an automatic letter opener.

7.15 pack (unpack)

to put in (or take out of) a protective container

Given publications to distribute, the worker packs them for shipment.

7.16 pull (extract, remove, separate, withdraw)

to remove from storage

Given a request for specific materials, the clerk pulls the materials from the file folders.

7.17 punch (perforate)

to make a hole through

Given a report to be bound, the clerk punches it for a spiral binding.

7.18 scrape

to remove from a surface by repeated strokes of an edged instrument

Given a spirit master to correct, the typist scrapes the master to remove the carbon.

7.19 seal

to secure against access by closing

Given a mass mailing, the worker seals the envelope with a moistener.

7.0 MANIPULATING

7.20 sharpen

to make a keen edge or fine point

Given a box of pencils to be distributed at a conference, the worker sharpens them.

7.21 splice

to unite by lapping two ends together

Given material typed on two stencil films, the worker splices the films.

7.22 stamp

to record with a stamping device

Given a number of purchase requisitions, the clerk stamps the time of arrival on each.

7.23 stuff

to put in

Given a mass mailing, the worker stuffs the envelopes with the materials.

7.24 thread

to place a thread, ribbon, or tape in position for use

Given the need to replace a typewriter ribbon, the worker threads the ribbon on the typewriter.

7.25 wrap (package)

to enclose with a protective covering

Given a magnetic tape to be transmitted, the worker wraps the box for mailing.

7.26 other

8.0 MODIFYING: making changes

8.01 adapt (adjust, alter, change, vary)

to change to fit the situation

Given a cost report to prepare for processing on the computer, the worker adapts the layout of the form for easy entry onto a punch card.

8.02 convert (transform)

to make a major change in

Given a posting machine which must be used for a payroll operation, the operator converts the machine for the payroll operation.

8.03 correct (debug, rectify, remedy, repair, right)

to change in order to set right

Given a situation in which a hotel reservation has been made for the wrong date, the secretary corrects the mistake by a long-distance call to the hotel.

8.04 decrease (abbreviate. condense, contract, cut, lessen, minimize, reduce, shorten)

to make smaller

Given a model of a form letter, the secretary decreases the number of words used in the explanation.

8.05 increase (amplify, augment, enlarge, expand, lengthen, maximize, supplement)

to make greater

Given a shortage of mimeograph paper, the office manager increases the amount ordered for the next fiscal period.

8.06 perfect (polish, refine)

to bring to an ideal standard

Given a number of form letters, the secretary perfects them before making a company mailing.

8.07 qualify (limit, restrict)

to change from a general to a restricted form

Given a request to type a lengthy report, the secretary agrees to type it but qualifies her statement by saying that she will type it only if she can complete her daily work first.

8.08 restore (reclaim, reconstruct, renew)

to bring back to a former or original state

Given a file drawer which was emptied by mistake, the clerk restores it to its original order.

8.09 revise (amend, improve, rearrange, revamp, streamline, update)

to improve, amend, or update

Given a number of personnel changes, the receptionist revises the roster of office employees.

8.10 temper (moderate, soften, tone)

to make less harsh or strict

Given standards for typing a legal contract, the office manager tempers the standards by allowing erasures in explanatory material.

8.11 transpose (invert)

to alter the sequence of

Given a number of form letters to revise, the secretary transposes the paragraphs to put them in a more logical sequence.

8.12 other

9.0 PURGING: destroying or eliminating

9.01 cancel (negate, nullify, rescind, revoke, void)

to destroy the effectiveness or validity of

Given a need to make a change in a planned itinerary, the secretary cancels her boss's hotel reservations.

9.02 consume (deplete, expend, use up)

to use up something

Given a tedious table to type, the worker consumes so much time in the typing of the table that she cannot complete her other work.

9.03 destroy (obliterate)

put out of existance or make ineffective

Given a confidential report in which some wrong numbers had been included, the typist destroys the copies by putting them through a shredder.

9.04 discard (dispose of, junk, scrap, throw away)

to throw away or reject

Given fourth class mail, the secretary discards all items not applicable to the business.

9.05 eliminate (delete, drop, exclude, reject, remove)

to delete nonessentials

Given a list of supplies requested by the steno pool, the secretary eliminates the items she considers nonessential.

9.06 weed (clean, clear, screen)

to remove selectively materials from files

Given the task of clearing the files at the end of the fiscal period, the clerk weeds out all materials dated six months prior to current date.

9.07 other

10.0 RECORDING: placing data or information on paper, film, tapes, or other media

10.01 chart (diagram, graph, plot)

to show graphically

Given the net sales and operating expenses, the clerk charts them on a bar graph to show relationships.

10.02 copy (facsimile, keypunch, microfilm, photograph, reproduce, typewrite, trace)

to make copies of by hand or by the use of a typewriter or copying machine

Given a request for five copies of a table, the clerk copies the table on an electrostactic copier.

10.03 duplicate (print, reproduce)

to make multiple copies of

Given an announcement to be disseminated, the clerk duplicates and distributes it.

10.04 post (credit, debit, journalize)

to transfer an item from one record to another

Given payments from the petty cash fund, the receptionist posts the payments from the petty cash book to the ledger.

10.05 register (book, enter, log)

to enter in a register

Given a number of purchase requisitions, the clerk registers them in the purchase requisition log.

10.06 tape

to record material on tape

Given punched cards which contain daily sales figures by departments the operator tapes the data through the use of a card-to-tape converter.

10.07 transcribe (translate)

to make a copy of dictated material

Given the morning's dictation, the secretary transcribes it on the typewriter.

10.08 write (handprint, handwrite, initial, inscribe, mark, mark sense, sign, take dictation)

to put down by hand on paper without the aid of machines

Given a telephone call for the boss while he was out of the office, the secretary writes the message on a telephone message form.

10.09 other

11.0 STORING: setting aside for future use

11.01 deposit

to place in storage designed for safekeeping

Given an abstract of real estate recently aquired, the clerk deposits the abstract in the company vault.

11.02 file

to arrange systematically for the purpose of preservation and reference

Given a batch of insurance policies from the computer, the file clerk files them numerically in the terminal digit file.

11.03 protect (guard, maintain, preserve, safeguard, shield)

to make safe from injury or loss by any of various protective means

Given a set of annual reports dating back to the company's founding, the file clerk protects them by putting them in dust proof file boxes.

11.04 reserve (hold, keep, retain, set aside)

to keep in store for future or special use

Given a short supply of parchment letterhead, the office manager reserves a supply to be used only for letters written by top executives.

11.05 stock (fill, provide, shelve, supply)

to provide with supplies

Given control of the supplies cabinet, the clerk stocks it with various office supplies.

11.06 other

12.0 TRANSMITTING: giving out or sending out

12.01 charge out (check out, issue, release)

to give out from one's custody, often on loan

Given a request for the XYZ Law Firm Folder, the file clerk charges it out.

12.02 circulate

to pass from person to person or place to place

Given the Christmas vacation schedule, the office workers circulate it among themselves.

12.03 deliver (bear, carry, hand over, move, transport)

to move from one place to another

Given the sorted incoming mail, the mail clerk delivers it to the various offices.

12.04 dispatch

to send with promptness or speed

Given an urgent message for the employer who is in another location, the secretary dispatches it by a messenger to him.

12.05 dispense (mete out)

to give out in controlled amounts

Given the job of controlling supplies, the clerk dispenses the stencils one quire at a time.

12.06 display (exhibit, post)

to put on display, generally in one location, for all to see

Given a floor plan for an addition to the building, the secretary to the vice president displays the plan on a bulletin board.

12.07 distribute (disperse, disseminate)

to send out to many

Given a forthcoming change of address, the secretary distributes an announcement of the new address to all customers.

12.08 forward (pass on)

to send to a different person or a different address

Given a situation where an employee is on leave, the mail clerk forwards his mail to his present address.

12.09 lend (loan)

to give for temporary use on the condition that the same or its equivalent be returned

Given numerous requests from the stenographer about how to spell words, the secretary lends her a dictionary.

12.10 publicize (circularize)

to promote by announcing widely

Given the installation of a new copying machine, the personnel clerk publicizes the new installation to the entire staff by an inter-office memo.

12.11 remit (refund)

to send money for payment

Given the monthly telephone bill, the bookkeeper remits the amount.

12.12 route (channel)

to prearrange and direct the order of distribution

Given a memorandum from the chief executive, the clerk routes it by attaching a slip, listing in order the names of the people to whom the memorandum is to be sent.

12.13 send

a general category to be used when none of the others are appropriate

Given a package of supplies to be delivered to a branch office, the clerk sends it by motor express.

12.14 submit

to give to another for his consideration

Given the pending purchase of a new duplicator, the secretary submits specifications describing the type of machine desired.

12.15 switch (exchange, hunt, transfer)

to move from one to another or back and forth

Given a call for a person who wishes to speak to several people in sequence, the receptionist switches the incoming call to the appropriate people in order.

12.16 other

I - OPERATING DOMAIN

13.0 VERIFYING

13.0 VERIFYING: determining the accuracy or inaccuracy of data

13.01 audit

to examine officially

Given petty cash records, the junior accountant audits them.

13.02 check

to inspect for satisfactory condition

Given material which appears not to have been coded correctly, the worker checks the coding with the subject classification manual.

13.03 proofread

to read and mark corrections

Given a typed manuscript, the secretary proofreads it, indicating needed corrections.

13.04 reconcile (account for, adjust, settle)

to adjust or account for differences

Given accounts receivable ledger sheets, the account clerk reconciles the total with the accounts receivable control account.

13.05 validate (authenticate, certify, notarize)

to determine and establish the genuineness of

Given a request for a travel reimbursement, the worker validates it by attaching receipts.

13.06 other

1.0 COMMUNICATING: oral means of requesting, giving, receiving, or discussing information

1.01 *affirm* (assert, claim, declare)

to declare that something is true

Given a situation in which supplies were taken from the storeroom, the worker *affirms* that she saw the clerk lock the cabinet at 5 p.m.

1.02 *answer* (reply, respond, retort)

to respond to

Given a question about the availability of the boss for a meeting on Tuesday, the worker *answers* that the boss will be out of town that day.

1.03 *canvass* (poll, solicit)

to determine or seek information by the taking of a poll

Given a new group insurance plan, the worker *canvasses* the employees to see how many will participate.

1.04 *consult* (confer)

to confer with knowledgeable persons

Given a need to print an annual report, the staff in the duplicating room *consults* the editorial director for advice about the best process to use.

1.05 *debate* (argue, dispute)

to discuss a question by considering opposing arguments

Given a new set of office regulations, the workers *debate* their merits.

1.0 COMMUNICATING

1.06 demand (emphasize, order)

to ask forcefully

Given an order which is long overdue, the worker calls the vendor and demands that it be sent immediately.

1.07 describe (narrate, recount, relate, report)

to give an account of in an illustrative manner

Given a situation in which the worker visits an office machines show, the worker describes a new type of copying machine which she saw.

1.08 detail (enumerate, specify)

to give information minutely

Given the job of arranging an itinery, the worker orally details the arrangements for the trip hour by hour.

1.09 discuss

to talk over

Given a task of updating the style manual, a group of secretaries discuss the proposed revision.

1.10 elicit

to motivate a response by the use of special techniques

Given the task of getting a confirmation by telephone from a speaker, the worker elicits his acceptance by emphasizing that the committee is unanimous in its choice of him as a speaker.

II - INTERACTING DOMAIN

1.0 COMMUNICATING

1.11 emphasize (stress)

to give prominence to by speaking forcefully

Given a report to prepare, the supervisor emphasizes the need for accurate typing.

1.12 explain (clarify, elucidate, interpret, rephrase)

to make something clear and understandable

Given an organization PERT chart, the executive secretary explains it to the stenographer.

1.13 express (voice, utter) (to be used only when other categories are not applicable)

to give oral expression to

Given a need to purchase a new duplicator, the operator expresses his opinion about the machine best suited to the job.

1.14 inquire (ask, query)

to ask for information

Given new regulations, the worker inquires about the reason for their establishment.

1.15 invite

to ask for one's participation or presence

Given the names of several office managers, the worker telephones each one and invites him to participate in a panel discussion.

1.16 listen (attend, hear, heed)

to pay attention to

Given a new job to perform, the worker listens to the instructions given by the boss.

II - INTERACTING DOMAIN

1.0 COMMUNICATING

1.17 negotiate

to try to reach an agreement

Given the complaint by workers that partiality is shown in work distribution, the office manager negotiates with the workers to reach an agreement on a fair method of distributing work.

1.18 page

to summon a person by repeatedly calling his name

Given 15 people in the waiting room, the worker pages the person who is next on the appointment list.

1.19 persuade (coax, convince, induce, sway)

to present views in such a way that others will be led to think in a like manner

Given the need for the purchase of an adding machine, the worker persuades the office manager to recommend the purchase of a ten-key machine.

1.20 question (interrogate, pry, quiz)

to ask a series of questions to bring information to light

Given a dictated letter to DPMA, the secretary questions the dictator by asking: What does DPMA mean? To whom should the letter be addressed? What is the mailing address? Should the letter be sent airmail?

1.21 quote (cite, refer)

to present supporting evidence

Given a question about the proper form for footnotes, the worker quotes the rule from the style manual.

1.22 repeat (reiterate)

to say again

Given a job of orienting a fellow worker to a new office machine, the worker repeats several times the importance of turning off the motor.

1.23 request

to express a need for

Given a letter to type to a government official, the worker requests a style manual from the secretary.

1.24 reveal (disclose, divulge)

to make known previously inaccessible information

Given the rumor that sales had declined, the secretary reveals statistics to repudiate the rumor.

1.25 suggest (advocate, recommend, urge)

to offer something for consideration

Given a task which has always been performed with the use of an adding machine, the operator suggests that it could be performed more efficiently with a printing calculator.

1.26 summarize (recapitulate)

to express the main idea in a few words

Given a detailed explanation of a company policy, the office manager summarizes the application of the policy to work procedures.

1.27 thank

to express appreciation for

II - INTERACTING DOMAIN

1.0 COMMUNICATING

Given a raise, the worker thanks the boss for his recommendation.

1.28 other

2.0 ASSISTING: moràle building, guiding, and training-type of activities performed by office workers

2.01 advise (counsel)

to give suggestions regarding a course of action

Given a situation in which an employee dresses inappropriately, the supervisor advises him about proper office attire.

2.02 aid (help, serve, support)

to give assistance to a person

Given a situation in which an employee has a rush job to complete, his fellow worker aids him by performing some of the work.

2.03 alert (caution, forewarn, warn)

to tell someone of something to be watched for or guarded against

Given a situation in which an irate customer calls at the office, the secretary alerts the boss to the customer's problem before admitting him to the boss's office.

2.04 encourage (assure, cheer, compliment, commend, foster, hearten, inspire, motivate, praise, reassure, support, stimulate)

to inspire by giving hope and confidence

Given a competent employee who lacks self-confidence, another employee encourages him by telling him about a compliment which the boss gave him.

2.05 escort (accompany, conduct, lead)

to accompany for the purpose of guiding or as a mark of courtesy

Given a group of visitors to the business, the receptionist escorts them to the president's office.

2.06 inform (appraise, enlighten, notify)

to impart information to make easier or faster the performance of the work

Given the same task performed by two employees, one informs the other of a more efficient manner of performing the task.

2.07 instruct (brief, coach, educate, explain, show, teach, train, tutor)

to teach

Given an employee leaving the job and a new employee entering, the departing employee instructs the new employee about the work procedures.

2.08 intercede (interpose, intervene, mediate, reconcile)

to attempt to reconcile two opposing sides

Given a dispute between two workers, the supervisor intercedes to reconcile the differences.

2.09 orient (acquaint, direct, familiarize)

to acquaint an individual with the office environment

Given the task of training a new employee, the secretary orients him to the location of the various facilities.

2.10 placate (allay, appease, assuage, calm, ease, mollify, pacify, quiet, relieve, soothe)

to make concessions to calm anger or hostility

Given a situation in which the secretary has angered her boss, she placates him by taking home some work to complete.

2.11 remind (refresh)

to call to another's attention in order to refresh his memory

Given a staff meeting at 1 p.m., the secretary reminds the boss of it before he leaves for lunch.

2.12 show (demonstrate, illustrate)

to point out in order to clarify

Given the task of training a new employee, the secretary shows how the duplicator is operated.

2.13 welcome (greet)

to receive a person hospitably

Given the job of receiving visitors, the worker welcomes them by inviting them to browse through the company literature.

2.14 other

II - INTERACTING DOMAIN

3.0 COPING

3.0 COPING: using of strategies to deal with threat:
positive action to overcome
negative action to overcome
action to escape
no action

3.01 accept (acquiesce, agree, assent, comply, concur, consent, subscribe, submit)

to agree to

Given a situation in which a number of workers are on vacation, the secretary accepts added responsibility.

3.02 adapt (accommodate, adjust, conform, fit, reconcile)

to adjust to prevailing standards or conditions

Given an electric typewriter to replace a manual machine, the worker adapts to the new typewriter.

3.03 admit (acknowledge, confess)

to acknowledge facts or situations

Given an employment test which she fails, the worker admits she cannot take fast dictation.

3.04 apologize (atone, repent)

to admit error and express regret

Given a situation in which one worker falsely blames another for an error, the worker who made the accusation apologizes to the one who was blamed falsely.

3.05 avoid (elude, evade, shun)

to depart or stay away from

Given a situation in which one worker finds another worker offensive, the worker avoids any contacts with that worker.

3.06 bluff (camoflauge, deceive, disguise, feign, pretend)

to handle a situation through the use of pretense

Given an opportunity to be considered for the position of administrative assistant, the worker bluffs his way to the top rank on the list of applicants by exaggerating his experience on the administrative level.

3.07 boast (brag)

to speak with excessive pride

Given an opportunity to replace a secretary who is on vacation, the steno pool worker boasts about it to her fellow workers.

3.08 charm (allure, attract, captivate, delight, enchant, fascinate, mesmerize)

to draw to oneself by personal appeal

Given a need for securing some young girls for clerical work, the secretary charms them by her enthusiasm for the company and her pleasing personality and appearance.

3.09 circumvent

to work around a problem by using ingenuity or strategy

Given the knowledge that two workers would like to serve as chairmen of the office personnel committee, the executive secretary circumvents the problem by creating two committees so that each one can serve as a chairman.

3.10 coax (cajole, persuade, urge, wheedle)

to influence by gentleness, tactfulness and sometimes artfulness

Given the need to replace the venetian blinds, the secretary coaxes the boss into buying the new vertical style rather than the horizontal.

3.11 compensate (counterbalance, offset)

to make up for

Given a situation in which a worker lacks ability to type at a fast rate, she compensates by typing with a high degree of accuracy.

3.12 compete (contend, oppose, rival, vie)

to vie in order to gain a desired objective

Given the announcement that there is a position open for private secretary, several stenographers compete for the position.

3.13 compromise

to come to agreement by mutual concession

Given two plans devised by office workers for rearranging the office furniture, the workers compromise by adopting some features from each plan.

3.14 cooperate (collaborate)

to work with others for mutual benefit

Given a large mailing, all pool workers cooperate to complete the job quickly.

3.15 disregard (ignore, omit, overlook, slight)

to pay little or no attention to

Given some gossip about a fellow employee, the worker disregards it.

3.16 empathize

to experience vicariously through the cognitive projection of oneself into the experiences and feelings of another

Given a situation where a fellow worker has a rude boss, the worker empathizes with him when the boss makes sarcastic remarks.

3.17 endure (bear, suffer, tolerate, withstand)

to tolerate trying circumstances

Given criticism by office workers on a new smoking regulation, the office manager endures the criticism.

3.18 excel (exceed, outdo, outshine, surpass)

to advance or distinguish oneself through excellence

Given a situation in which a department is to be phased out, the worker excels so he can be transferred to another department.

3.19 forgive (excuse, pardon)

to cease to feel resentment against

Given a situation in which the supervisor makes cutting remarks to the clerk, the clerk forgives her.

3.20 hint (insinuate, intimate)

to infer rather than to say explicitly

Given a situation in which a worker wears mini-skirts, the supervisor hints that her dresses are too short.

3.21 improvise

to create on the spur of the moment

Given a sudden need for a conference room, the secretary improvises by setting up the reception area for the conference.

3.22 innovate

to introduce as new

Given the need to increase production, the supervisor innovates the procedures used in another department with a high production record.

3.23 obey (comply, follow, heed)

to follow directions

Given an office manual stating that there should be no smoking at desks, the worker obeys the rule.

3.24 persevere (persist)

to continue in spite of opposition or discouragement

Given a three-day deadline for typing a statistical report, the typist perseveres and completes the report on time.

3.25 rationalize

to provide reasonable, plausible justification for one's actions by distorting the truth, either consciously or unconsciously

Given a situation in which a worker continually takes long lunch breaks, he rationalizes by saying the extended time makes him work more efficiently.

3.26 refrain (check, constrain, curb, repress, restrain, subdue)

to keep oneself under control by holding back

Given a situation in which a caller makes unpleasant remarks because a company official cannot see him, the receptionist refrains from giving unpleasant replies.

3.27 refuse (decline, deny, reject)

to not comply

Given a request for confidential cost figures, the bookkeeper refuses to reveal them.

3.28 respect (esteem, honor, revere, venerate)

to consider worthy of high regard

Given an opinion by the office manager on the best way to organize a mass mailing, the worker respects the manager's opinion.

3.29 socialize (participate)

to participate actively in a group

Given the need to establish better rapport with office personnel, the supervisor socializes during coffee breaks.

3.30 verbalize

to release one's feelings or overcome situations by talking

Given a situation in which a boss continually changes his mind, the worker verbalizes on his inability to get things done because of the boss's indecisiveness.

3.31 withdraw (alienate, clam up, isolate, retire)

to remove oneself from participation

Given a situation where fellow employees are making catty remarks, the worker withdraws and refuses to comment.

II - INTERACTING DOMAIN

3.0 COPING

3.32 yield (concede, defer, relent, submit)

to submit to another's ideas or wishes

Given a disagreement about the cover binding for a report, the supervisor yields to the wishes of the department head.

3.33 other

1.0 PLANNING: mental determining of a course of action

1.01 analyze

to determine the nature and relationship of parts

Given the need to increase production, the worker analyzes his work procedures to determine which ones may be improved.

1.02 budget

to provide for the use of in detail

Given a large amount of work to be done, the worker budgets his time to make it possible to meet deadlines.

1.03 classify (categorize, group, partition)

to create categories in order to group ideas, people, or activities into sets according to common elements

Given a reorganization of departments, the supervisor classifies the work to determine the number of clerical employees needed.

1.04 design (create, devise, originate)

to formulate a plan or pattern to accomplish a desired objective

Given the job of checking reports from the computer, the worker designs a new work routine to enable him to keep up with the output of the computer.

1.05 forecast (anticipate, predict, prognosticate, project)

to attempt to indicate future conditions

III - MANAGING DOMAIN

1.0 PLANNING

Given the need to prepare a budget for equipment and supplies for the stenographic pool, the supervisor forecasts the volume of work for the next six months.

1.06 other

2.0 ORGANIZING: establishing the work environment

2.01 allocate (allot, apportion, divide, prorate)

to divide in amounts suitable for efficient performance

Given six statistical reports to be typed, the supervisor allocates them to experienced typists.

2.02 appoint (assign, commission, designate, name)

to name an employee to fill a specific position or perform a specific task

Given a request to reduce the waste of stationery supplies, the supervisor appoints an employee to dispense all stationery.

2.03 automate (automatize)

to establish operation by an electronic device to replace mechanical or human effort

Given the need for faster output and more information, the office manager automates the collating operations.

2.04 centralize

to place in one location or with one person or group

Given the need to establish a tighter control of the files, the office manager centralizes them.

2.05 decentralize

to disperse or distribute from one location or person to several

Given the need to establish control on a departmental basis, the office manager decentralizes the handling of purchase requisitions.

2.06 delegate (empower)

to entrust authority to another

Given the need to give out keys to supply areas, the supervisor delegates the responsibility to a trusted employee.

2.07 dismiss (discharge, free, layoff, release)

to remove from employment or a specific activity

Given the installation of a magnetic ink sorter-reader, the office manager dismisses the employees who have been involved in manual check sorting.

2.08 eliminate (destroy, remove)

to get rid of

Given the installation of an electronic calculator, the clerk eliminates the forms used on the posting machine.

2.09 employ (hire, recruit)

to select personnel for office positions

Given a choice from among three applicants, the supervisor employs the one with the most experience.

2.10 equip (furnish outfit)

to provide with the necessary materials and machines to perform a designated function

Given authority to set up facilities for a central transcribing room, the supervisor equips the room with the needed machines.

2.11 schedule (assign, "PERT" (Program Evaluation Review Technique) program)

to place in a time sequence

Given a posting machine used by several workers, the clerk schedules the hours when each will use the machine.

2.12 systematize (arrange, order, routinize)

to arrange in an orderly or methodical manner

Given a new activity to perform, the worker develops a new procedure in which he systematizes the operations involved.

2.13 other

III - MANAGING DOMAIN

3.0 ACTUATING

3.0 ACTUATING: stimulating and maintaining of performance and effecting corrective measures

3.01 adjust (adapt, modify, rearrange)

to change to meet a new situation

Given a work assignment with top priority, the worker adjusts his work schedule.

3.02 enforce (compel, drive, impel, impose)

to require adherence to

Given a regulation that there is to be no smoking at desks, the supervisor enforces the regulation by reprimanding employees who violate it.

3.03 expedite (accelerate, hasten, rush)

to give special attention to in order to process or move quickly

Given an immediate need for a shipment of paper, the clerk expedites the order by telephoning the supplier.

3.04 implement (accomplish, effect, fulfill)

to use measures that will ensure the carrying out of

Given the automation of the payroll, the clerk implements the new procedures.

3.05 initiate (establish, inaugurate, institute, introduce, launch)

to set going

Given a program for automating the payroll, the office manager initiates the steps to effect the change.

3.06 motivate (induce, inspire, prompt, spur)

to stimulate to action

Given a need to increase the production rate of the stenographers, the supervisor motivates them by stating that pay increases are based on production.

3.07 perform (carry out, execute)

to do what is provided for or required

Given a job assignment, the worker performs the tasks involved.

3.08 substitute (replace)

to put in the place of another

Given a packet to assemble for a convention, the worker substitutes a week's guide of activities in the city when she runs out of maps of the city.

3.09 other

4.0 CONTROLLING: evaluating work performed and determining and recommending corrective measures

4.01 approve (authorize, confirm, enforce, OK, ratify, sanction)

to give favorable or positive support to

Given a number of typed masters, the supervisor approves them for duplication.

4.02 disapprove (condemn, reject, veto)

to indicate dissatisfaction

Given work completed by a typist, the supervisor disapproves it.

4.03 evaluate (analyze, appraise, assess, estimate, judge, rate, value)

to determine the value of

Given the letters which a stenographer typed on her first day of work, the supervisor evaluates her ability by examining the letters.

4.04 limit (circumscribe, curtail, restrict)

to establish boundaries

Given the need to reduce reproduction costs, the office manager limits the use of the copier to incoming correspondence.

4.05 permit (allow, authorize, let)

to grant permission or allow something to be done

Given the need for immediate reproduction of 15 copies of a table, the office manager permits the clerk to make the copies on a copying machine.

4.06 prevent (avert, forestall, preclude, stop)

to keep from happening

Given a financial report to put on the computer, the clerk prevents the occurrence of a costly error by correcting the transposition of numbers.

4.07 recommend (advocate, prescribe, suggest)

to declare in favor of

Given an increased number of employees, the payroll supervisor recommends that the hourly payroll be automated.

4.08 regulate (direct, govern, manage, order, regularize)

to control or direct by some designated principle or method; to adjust to some standard or requirement

Given a batch of invoices to process, the supervisor regulates their distribution to the machine operators.

4.09 supervise (direct, oversee)

to oversee

Given the supervision of a number of calculating machine operators, the department head supervises their work.

4.10 other

IV

HARDWARE: A NEW MAN-MACHINE INTERFACE

Norman F. Kallaus, College of Business Administration, The University of Iowa

> It is an extraordinary era in which we live.
>
> It is altogether new. The world has seen nothing like it before. I will not pretend, no one can pretend, to discern the end; but everybody knows that the age is remarkable for scientists research into the heavens, the earth, what is beneath the earth; and perhaps more remarkable still is the application of this scientific research to the pursuit of life. The ancients saw nothing like it. The moderns have seen nothing like it until the present generation. . . . The progress of the age has almost outstripped human belief.

Those words--echoing the spirit of the times--were not spoken today, though they set today in perspective, but were used in 1847 by Daniel Webster when he opened a new stretch of railroad track in New Hampshire. A greater parallel seems to exist between that day--six scores of years ago--and our own day than we normally realize.

In Webster's time, science was first applied on a wide scale. Man and machine were combined to produce a new society--our first industrial society--out of which came many problems which plague us still.

When one glances back at the great technological upheaval of Webster's day, the real significance of the machines which helped bring it about is the human and social change that accompanied their use.[1]

When today's world of IBM and intercontinental missiles, Telestar, and television is compared with the primitive technology of 19th century America, the significance (if not complete dependence) of man to machine comes into sharp focus. Through a period of constantly escalating activity in technology, machines have become a vital part of global life.

This paper is concerned with machines. In it the relationship of machines to the development and transmission of knowledge will be explored as well as the close dependence of the office world upon machines which process information. To do this requires a brief reexamination of the office function and some key office concepts. On such a base can then be projected the unfolding and unending story of machines which have become a firm fixture in our present-day offices. Primary emphasis will be given to general office machines, although, of course, no survey of machines today is complete without some mention of the powerful electronic computer. This material, it is hoped, should be useful to both groups: business teachers and their students who theorize and businessmen who utilize machines.

MACHINES AND THE WORLD OF WORK

A machine is a device that does work. In Webster's time, machines were introduced into American factories as a substitute for some of the backbreaking sweatshop labor conditions in the factories. On a much wider scale today industries use machines--giant drills, lathes, and presses--to make the products we use. Similarly, in the office, businesses have grown more dependent on typewriters, calculators, and other common machines. Automobiles, airplanes, trucks, and railroads transport us; TV, radio, and the movies entertain us; projectors, computers and recorders enlighten us. Almost every activity of daily life revolves around the use of machines.

Most machines consist of a number of elements, such as gears and ball bearings, that work together in harmony. This definition could include such simple machines as jack screws for raising houses, to computers for lowering production costs. But no matter how complex they are, all machines in turn are based in some way on six types of simple "machines."

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[1] John Diebold, "The New World Coming," Saturday Review (July 23, 1966), p. 17.

lever
wheel and axle
pulley
inclined plane
wedge
screw

Early man worked solely with his head, his hands, and his feet. In this simple case, we see a direct man-work relationship. (Figure 1)

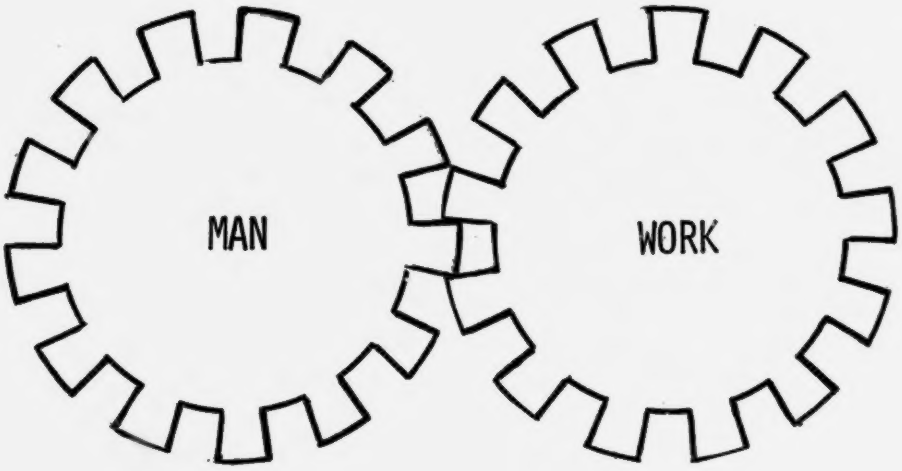

Fig. 1. Early relationship of man to his work.

With the introduction of machines, however, a new dimension was added to man's work system. In Figure 2 this relationship is sketched. A new partnership was, in fact, born, for man would seek new uses of machines to relieve his labors; and in turn seek new and better machines to improve on old applications and devise new ones.

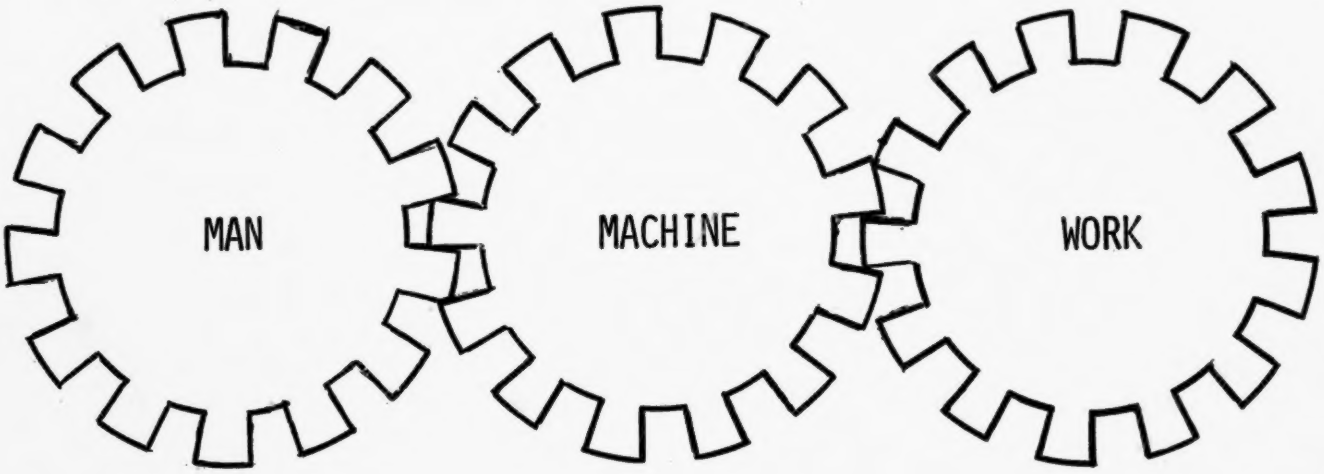

Fig. 2. The man-machine-work system.

The wheel and axle, the inclined plane, and the pulley are commonly used in office machines. In fact, most of the modern general office machines are based directly on the use of the wheel (as in the case of counting dials in calculating machines). A relatively recent invention, but next to the wheel perhaps the most revolutionary machine of all times--the computer--is largely based on internal electronic signal circuitry, which gives it much greater capability. Some even admit that with the invention of the computer came the end of the age of the wheel.

There is an increasing demand in industry today for new machines to perform new tasks and for improvements that will increase the value of old machines.[2] And as the world becomes more and more a white-collar world of clerks, stenographers, data processors, and managers, this same demand for machines grows with intensifying force in the office.

THE CHANGING OFFICE: AN INFORMATION CENTER

Our early offices were considered locations, places where clerks worked. At the same time associated with this clerical work is the item on which their work centered: paper. With this emphasis on "paperwork," however, the real purpose of the office was overlooked.

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[2] World Book Encyclopedia, Vol. 13 (1966), pp. 9-11.

Today's office world still contains clerks and paper. but it is now thought of as paper with a purpose. Changing concepts of the office function and the role of machines in the office have broadened the office role, giving it more status and importance. Several of these key concepts appear below.

Office Work Force

The great growth in our economy has generated a thirst for information. And conversely, the ability to furnish more information has assisted in the growth in the economy. Look, for example, at this statistical economic profile:[3]

1. 1961-1968:

    U.S. population increase of 7%
    personal income up 35%
    industrial output jumped 43%
    retail sales up by 33%
    construction up 28%
    employment up by 10%

2. Results of this growth:

    more people
    more laws
    more communications equipment
    paperwork and red tape
    power and energy sources
    taxes
    government regulation
    information
    speed
    knowledge

In this fast-growing economy the office has played an expanding part. Modern-day sophistication often describes the office in such fancy terms as these:

communication center
information center
data center
memory center
decision center
records center

Even though it is a center of activity, in a very real sense, the office still remains a pencil-pusher's paradise. With the advent of additional machinery in the office to produce more copies and with the advent of new management techniques for developing new uses of information, the office world has seen a critically high rise in the amount of paperwork and, accordingly, in the growth of the clerical work force. The "shift" from a blue-collar to a white-collar work force is shown in Table 1.

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[3] Robert A. Shiff, Information and Records Management, Vol. I, No. I (October-November, 1966), p. 19.

Key Concepts in Office Work

An organization tends to be divided into related functional parts and segments. In fact, work, too, can be so divided. In another sense, the unification of these parts results in a system or a network of mutually dependent parts. A key concept in today's office world is this concept of system.

The system that is designed and installed to achieve a desired goal has office and plant counterparts. In both cases, a significant portion of the system now involves the use of machines.

Today's office system is no longer one that stresses paper-shuffling or pencil-pushing, but rather working with information. All offices share this common function. In fact, the office has taken on a newly found importance when one considers that management makes its decisions on the basis of the information which the office furnishes. Any system combines its resources in this way:

1. Management, which directs
2. Men, who control and operate
3. Machines, which convert
4. Materials, into products or services made available to
5. Consumers, whose purchases are also sought by
6. Competitors
7. Government and the public.[4]

While this system outline refers to "products," it can apply with equal force to "service," and "information," the products of the office. Information in the office system then enters the communication system for stimulating action within the organization.

Key Office Functions

To understand the role machines play in the office, one should first look to the various functions

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[4] Richard A. Johnson, Fremont E. Kast, and James E. Rosenzweig, The Theory and Management of Systems (New York City: McGraw-Hill Book Co., 1963), p. 51.

Table I

ANALYSIS OF DRIFTS IN THE COMPOSITION OF THE UNITED STATES LABOR FORCE[a]

Ben S. Graham Jr.

	1940 (figures in 1000's)	Rank	1959 (figures in 1000's)	Rank	July 1967 (figures in 1000's)	Rank	Increase 1940 to July 1967	Increase 1959 to July 1967
Clerical	4371	4	9093	2	12768	2	187%	38%
Professional	3566	6	7196	4	9353	4	162%	30%
Service	3188	7	5837	6	7740	5	143%	33%
Managerial	3620	5	6878	5	7640	6	112%	12%
Crafts	5152	2	8438	3	10118	3	96%	20%
Operators	8052	1	11586	1	14178	1	76%	22%
Sales	3072	10	4278	7	4553	7	48%	9%
Labor	3123	8	3826	8	4170	8	33%	9%
Household	2083	11	2283	11	1729	11	-17%	-24%
Farm Labor	3099	9	2467	10	2110	9	-32%	-14%
Farm Mgrs.	5144	3	3128	9	2063	10	-60%	-34%

Sources: Statistical Abstract of the U.S. Department of Commerce, Bureau of the Census; Employment and Earnings, U.S. Department of Labor; also available in most yearly almanacs published by the larger newspapers.

[a] Presented to the Des Moines, Iowa, Chapter of the Systems and Procedures Association, October, 1967, by Ben S. Graham Jr., systems consultant.

or *duties* performed. If a survey were taken of most office workers' duties, the first question asked might well be, "What kind of work do you do?" Typical "action" answers might be: "We . . .

1	*2*	*3*	*4*
add	*record*	*edit*	*decide*
subtract	*type*	*design*	*delay*
multiply	*transcribe*	*destroy*	*store*
divide	*receive*	*sum*	*retrieve*
extract	*post*	*discuss*	*pay*
list	*weigh*	*copy*	*bank*
duplicate	*print*	*draft*	*phone*
classify	*file*	*feedback*	*process*
index	*post*	*answer*	*control*
sort	*proofread*	*respond*	*report*
select	*verify*	*mark sense*	*compose*
total	*eliminate*	*evaluate*	*order*
convert	*interpret*	*plan*	*organize*

Each of these duties is commonplace for these tasks occur in all offices from time to time. What is important to consider, however, is that the majority of these functions--or routines--can be performed by machine. In fact, all of the thirteen functions in Column 1 as well as several in the other columns are listed as functions of the punched hole in the punched-card system.[5]

Since many of the manual office functions are being replaced by machines, an important point to ponder is the potential which machines hold for processing the remaining information-handling duties.

THE OFFICE MACHINE: AN INFORMATION MACHINE

A close study of office machines and their applications quickly suggests that they have a common denominator. Whether the machine be a typewriter, probably the best known and most widely operated machine, or an electronic computer, undoubtedly the most complex and most powerful and important machine, *these machines all deal with information*. In fact, it is probably a misnomer to continue to call them *office* machines, for they are used in many places other than an office, although admittedly they do perform office functions in a home, in a factory, or in a field office in the military services. Since all these machines deal with information, it is now evident that they should be called information machines for this is their basic purpose.

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[5] *Principles of IBM Accounting*, International Business Machines Corporation (1953), p. 9.

An Overview of Information Machines

The machines used in today's office continue to grow in number and in type. In fact, machines have become such a vital part of today's office world that we often hear this era called the "age of information technology."

To get an idea of the scope and complexity of the machines picture facing a businessman or a business teacher or even a business student, refer to Table 2.

New Machine Issues

Recently *Fortune* magazine, in an eye-opening article, called the knowledge industry the fastest-growing industry in the world.[6] A study of this article reveals that significant portions of this new industry relate to information-processing machines used in the office. Names like IBM, NCR, Control Data, Xerox, Eastman Kodak, Litton Industries, Sperry Rand, and GE are prime movers in the world of machines. Students of business trends (whether businessman, business educator, or business student) should be aware of the important trends in this industry so that they can adjust to them in as near a real-time (just as they occur) fashion as possible. Some of the key trends and issues are outlined in this section.

Importance of System. This is a systems-oriented world, militarily, politically, industrially, economically, socially, educationally. The systems cycle (input, processing, output) through which information is processed utilizes machines at each step to help handle information. Whenever such a machine is considered for handling information this presupposes a study of the system in which it will function. Key questions in such a study are the following:

1. How does a worker fit into the system?
2. How does the machine fit into the system?
3. How is the man-factor in the work system "altered" when a machine is added?
4. How does the man feel about his whole/partial replacement by machine?
5. How much can the machine do to relieve the man? Does the man want relief?

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[6] "Knowledge: The Biggest Growth Industry of Them All," *Fortune*, Vol. LXX, No. 5 (November, 1964), pp. 128-131.

Table 2

INFORMATION MACHINES: A TABLE OF MACHINE TYPES BY INFORMATION FUNCTION PERFORMED*

Common Information Function	Mach. Level: M=mechanical EM=electro-manual EL=electronic	Machine types	Special machine characteristics/applications
record	M	typewriters (manual and electric)	text, correspondence, manuscripts
	M	automatic	form-letter typing
	M	varityper	special composition and proportional typing
	M	time recorders	payroll, etc.
	M	cash registers	
	M	dictating-transcribing machines	
	M & EM	keypunch (portable and cardpunch)	punched-card entry
calculate	M	adding: full-keyboard 10-key adding	adding and subtraction, repeat-add multiplication
	M	calculators: rotary	multiplication and division
		printing	addition; automatic multiplication and division
		key-drive	addition; multiplication
	M	accounting machines (posting/bookkeeping)	billing, posting and routine accounting

Common Information Function	Mach. Level: M=mechanical EM=electro-manual EL=electronic	Machine types	Special machine characteristics/ applications
	M	calculators: electronic	special functions (square root etc.); extra speed and storage registers
	EM	accounting machine (punched card)	adding, printing, subtracting, & listing
	EM	punched-card calculator	all arithmetic processes
	EM	paper-tape machines: record/calculate	Flexowriter; Computyper
	EL	computer	arithmetic processes; internal storage; comparing processes
reproduce (and copy)	M	duplicating: spirit stencil offset	 300 or less copies 300 or more copies thousands of copies
		copiers: wet & dry processes	convenience copies
	EM	punched-card reproducer	gangpunching, etc.
store and retrieve	M	microforms: microfilm microcards microfiche aperature cards chips	Note: each microform has its own type of reader/ printer most of which are operated manually.
	M	file cabinets	electrified storage and retrieval (e.g., Rem. Rand's Lektriever)

Common Information Function	Mach. Level: M=mechanical EM=electro-manual EL=electronic	Machine types	Special machine characteristics/ applications
sort (and select and collate)	M	hand sorters needle sorters	keysort with edge-notched cards
	M	collators	for assembling documents
	EM	sorter, collator (punched card)	
	EL	computer	can perform sorting function
Miscellaneous:			
mailing	M	openers, sealers, folded, inserted scales, meters	
paper-handlers	M	cutters; punches, perforators, folding machines; binders	
communication acquisition/display	EL	computer	
reader/scanner	EL	scanners	
addressing	M/EM	addressing machines	for large mailings

* The list of machines in Table 2 includes commonly found machines to process information. No effort has been made to make the list all-inclusive.

In summary, just what is the man-machine relationship in the work system? What human tasks cannot be performed by machine?

Systemation of Work. Just as the automation of machines gave us "automation," so, too, has the systematization of work provided us with an abbreviated term, "systemation." The results of systems improvements in information-processing have been many important changes in company organization as well as in the organization of people and work. Particularly important are the following:

> *Standardization* of office work.
>
> *Centralization* of information handling in business, industry, and government. For example, standardization of operations permits all branch operations to centralize their office work in a corporate headquarters, especially since the advent of computers and improvements in communications. Other recent evidences of standardization and ultimately centralization of educational data processing of all public school systems appear in several states. Similar moves are being planned by county governments, state governments, chains of private colleges, and the like.
>
> *Integration* of machine functions (especially adapting EDP features to small-scale noncomputerized machines). Recent examples published in the December, 1967, issue of Business Automation refer to the merger of copier and computer. In this illustration Bell Labs and Xerox have collaborated to develop a system which would print directly on ordinary paper any visual display that a computer could produce by interconnecting the computer and a graphic terminal unit to a special type of printer. Other examples of such integration include a machine with a typewriter keyboard which also has the ability to calculate, add, and write, as well as produce a machine readable output for later computer processing; and National Cash Register's Opti-Printer adding machine which prints numbers on a paper tape that can be read by both an optical scanner and the human eye.

Engineering Improvements. Essentially office machines have changed little in concept through the past few decades. Perhaps the only significant single machine concept exception is the computer with its capability for internal storage of information and its so-called "logic" function. In most, if not all, other respects, the improvements in information machines have been engineering refinements. Typical of these refinements are the following:

1. Machines are more efficient, often with less down time.

2. Machines are more attractive, with more attention given to design and esthetics.

3. Machines operate more quietly and with greater ease (e.g., the new electric calculators and typewriters compared with their counterparts of the 1940's).

4. Machines are being offered in bigger price ranges. For example, you can purchase an electric adding machine in a discount store for less than $75 and an expensive ten-key printing calculator for ten times that figure. Hand-operated rotary calculators may sell for $200 while electronic calculators may sell for $2000. With this trend toward low-cost calculating, typing, and other office machines, students, doctors, lawyers, as well as housewives may have them for personal use.

5. Machines are more compact (miniaturized). It is therefore, possible to purchase dictating machines to fit your shirt pocket, portable electric typewriters, and very small portable calculators.

6. Machines are being offered with expanded functions. For example some calculators today have several registers for storage; accounting machines now have externally stored programs.

7. Machines are more compatible with other machines, that is, can be used with other machines. This "integratable" feature permits one to use a machine to copy a diagram onto a spirit process master which can then be duplicated on the spirit machine. A printing calculator can produce an adding machine tape and at the same time a punched paper tape of the information processed which can be inserted into a compatible typewriter which can type out (in decoded form) the results of the calculator operation.

8. Machines are now having mechanical parts replaced with electronic parts. This trend, in itself, has an immediate effect on the cost of getting into production and also the price of new products. For example, since there are 3,500 parts in a rotary desk calculator and tooling for these parts alone costs millions of dollars, this fact has kept many companies from entering this type of production.[7] Significantly, there still remain but three major domestic producers of rotary calculators, though there are many more in other fields of information machine production.

Perhaps the most noteworthy entry into the office-machine market in the last 15 years has been the copier. This device has altered many of the typing-charting-drawing duties in the office and at the same time has helped to create the paper glut due to its accessibility and potential for misuse.

INFORMATION MACHINE TRENDS

The "hot breath" of automation is causing the general-office machines manufacturers to be on "standing alert." In fact, many of the present improvements in these machines reflect the faster pace and faster growth of the computer industry and the tremendous investments in research and development in which such firms have engaged. But the growth in the sales of general office machines has been healthy, as viewed by an official of the Business Equipment Manufacturers Association:

> Far from undercutting the traditional office equipment the advent of electronic computer systems has actually increased the demand for the workhorse business machines, as improved to meet today's needs for increased speeds and versatility, and compatibility with integrated systems. In our segment of the Industry (the Office Machines Group of BEMA), we have been witnessing an average yearly 15% sales increase for most of the past decade of automation.[8]

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[7] Eugene Murphy, "Trends in Office Machines," Paper 4, Business and Office Education, Research Planning (Columbus, Ohio: The Center for Vocational and Technical Education, March, 1966), pp. 75-76.

[8] "General Office Machines," Dun's Review and Modern Industry, Special Supplement II (September, 1965), p. 140.

The remainder of this paper deals with machine trends--the emerging hardware of the office. To be useful to the reader, it is necessary to group the machine trends by level of machine complexity. A common, though perhaps arbitrary, classification, is to speak of "general office machines" and "data processing machines." Even though all office machines are information or data-related, this traditional classification seems useful to discuss machine trends and predictions; hence, it will be used in this paper.

General Office Machines

While the numbers of machines continue to grow, the types of machines also show growth, but comparatively slower. For instance, such useful devices as electric scissors, electric erasers, and electric wastebasket-shredders have been introduced, but have not yet made a strong impact in the office machines field. The following machines, however, all common "bread and butter" machines, continue to remain strong in the office equipment field. Hence, each of these machines will be briefly discussed.

Typewriters--Much of the machine-processing of information in today's office continues to revolve around the typewriter. Since E. Remington and Sons, gunmakers, of Ilion, New York, placed the first commercial typewriter on the market back in 1874, dozens of millions of typewriters have been sold. At the present time, in fact, between 12 and 15 million typewriters are in use in offices. In addition, between 1.5 and 2 million portables are sold annually, a figure which continues to grow steadily.[9]

Other significant points about typewriter trends and practices follow:

1. The electric typewriter continues to make inroads into the total number of units sold, though the sales of manual (nonelectric) machines are steady. Proportional-type machines (e.g., IBM's Executive line) continue to be restricted largely to the executive suite.

2. Lower-priced electrics are effectively

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[9] Dun's Review and Modern Industry (September, 1965), p. 142.

competing with standard (nonelectric) machines, especially for small-office or personal use.

3. In general, attention is given to perfecting the operation of the machines (crispness of work; more done with less fatigue); and pleasing designs (sculptured beauty); and supplementary features such as easier ribbon-change cartridges.

4. Typewriters are now being integrated to a greater extent with computers (printouts, inquiry stations, etc.) and automatic typewriters, too, have been applied in such a manner.

5. The major change in typewriter concept occurred in 1961 when IBM's Selectric typewriter was introduced. This machine, which substitutes the typebars and movable carriage with a sphere-shaped typing element, has had a strong impact on the typewriting market. One particularly pleasing feature is the variety of type styles that can be used since the type element may be easily removed by the typist in a few seconds.

6. Automatic typewriters have been further defined to personalize the typing of form letters, precomposed, numbered letters or paragraphs. In addition to the use of the piano-roll input, other improvements have been introduced. One, for example, makes possible the continuous feeding of a deck of individual file tapes, and the automatic selection of four pieces of coded material from each tape.[10]

7. The Varityper, a less well-known specialized typewriter, is useful for preparing promotional literature and copy for offset reproduction. This machine now has even more type styles, proportional spacing (e.g., being able to develop even right margins), and still dominates the composition-by-typewriter field.[11]

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[10] _Ibid._, p. 189.

[11] _Ibid._, p. 142.

Calculating Machines--More and more we become a world of numbers. And wherever numbers appear, calculating becomes a prominent part of the processing of data. These calculating machines which are below the level of the computer have long been a prominent part of the office system--for almost a century for the most part. Their future role seems guaranteed, especially with these important developments:

1. The so-called automatic calculator has made firm inroads into the market. Basically it is a small computer and operates electronically with counting circuits (not moving mechanical wheels) so that its speed is literally the speed of light. One manufacturer claims these speeds:

   addition & subtraction: 1/100 second
   multiplication: 1/4 second
   division: 1/2 second

   Besides speed, these machines have such features as floating decimal placement, keys to select the number of decimal places desired as well as for ruling off or elimination of extra digits, and "recall" to bring back figures to be used later (e.g., constant divisors or multipliers). This last feature, of course, eliminates the time-consuming and error-producing operation of reentering numbers that are used again and again.

2. Storage registers are being provided in electronic machines for holding intermediate results within the machine. Thus, the "store" keystroke replaces the copying down of a number by recalling the number from a memory register, a big factor in reducing number-entry errors.

3. Miniature versions of calculators are appearing. One of pocket size weighs only eight ounces.

4. Simple improvements in design and operation appear on all models. Some short-cuts, such as double- and triple-cipher keys speed up the keying of round-figure numbers. Speeds presently range from 180 rpm to 250 rpm with accoustically designed housing making the machine more comfortable to use. Column indicators, credit balance, automatic printing

> of negative numbers in red, interlocking of control keys to reduce error from simultaneous depression of two keys as well as other control keys are all a part of the full-key and ten-key adding machine market.[12]

Engineering improvements include the use of solid-state units in calculators and hence fewer mechanical parts. On electronic machines cathode ray tube displays replace answer dials.

Significant changes are occurring in the demand for machines. The Business Equipment Manufacturers Association (BEMA) reports these changes:

In 1950: 90% of all adding machines sold were full-keyboard machines.
10% of all adding machines sold were ten-key adding machines.

In 1966: the above figures were reversed.

Such statistics mean a change in the demand for machines. Key-drive calculators (Burroughs, Comptometer, etc.) appear in far reduced numbers today, and machine manufacturers and their representatives frankly admit that the demand for rotary calculators is lower compared to ten-key machines. Having a remarkably strong growth is the printing calculator, especially with the improvements in fast printout.

The calculating machine is, perhaps, more important to the information function of the office than most of us realize. For example, BEMA noted that in 1966, it was the calculating machine, *NOT THE TYPEWRITER*, that was the most common machine in our offices, and by a two to one ratio! A glance at any large general office should prove the validity of this statistic.

Reproducing Machines--The reproducing machines in the general office fall, quite naturally, into two broad categories: 1) the traditional duplicators; and 2) the contemporary copiers.

The traditional "big three" still dominate the duplicating machine market, although there are shifts in the relative demand for each type of machine. These three--the spirit-process machine, the stencil-process machine, and the offset machine--all have useful applications in today's reproducing market. Although they are frequently misapplied, a recent survey conducted by the Copy-Rite Corporation, Chicago, shows that firms using duplicators prefer the spirit process, stencil process, and offset process in that order. Mention was made of the fact that the spirit process is usually limited to less than 300 clear copies; that the stencil machine is used for larger quantities, that is, over 300 copies; and for long runs (thousands of copies) the offset process is the most practical machine.[13]

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[12] John Medlin, "Calculating and Adding Machines," Administrative Management, Vol. XXVIII, No. 10 (October, 1967), pp. 70-78.

The offset machine, of course, is a late comer to the duplicating machine market. And with it has come some reduction in the demand for the stencil process. Especially is this understandable if one considers that the offset machine easily incorporates a merger of several functions. For example, the photographic and duplicating processes can be integrated by platemaking (a photographic process in which copy to be duplicated is photographed onto an offset master). The result is an increase in the less expensive and time-saving in-house printing of publications and reports.

Relatively little changes have occurred in reproducing machine concepts. Rather, what has occurred is an inevitable improvement in machine engineering. Examples include one-button control of several machines under one operator; copy positioners for aligning the copy by machine; extra capacity feed trays for long runs; various types of fluid conduit indicators; and a bigger line or choice of masters. Stencil machines now permit operation with paste ink for cleaner, more uniform copy; the use of single- and double-cylinder machines for a more even distribution of ink and clearer copies; as well as machine interleaving or collating of inserts between each copy.[14]

In a short decade, the office copier has grown to manhood--from a small $50 million industry to a robust $700 million in 1966, and in 1968 it may well reach the billion dollar mark.[15] Industry spokesmen, in fact, predict a growth rate of 20% a year and that more than 25 billion impressions will be made in 1970.[16] Currently there are more than forty companies in the copier field (big names include Xerox, 3M, and Eastman Kodak) producing machines which employ photographic, chemical, electrostatic, or heat-transfer methods.

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[13] John Medlin, "New Duplicators: More Automated, Cleaner Operation," *Administrative Management*, Vol. XXIX, No. 1 (January, 1968), p. 48.

[14] *Ibid.*, p. 53.

The copier is not designed to replace the duplicating machine. In fact, much of its use and abuse involves the overproduction of paper since it is relatively simple to make copies for everyone in the office. Emphasis in the copier market is still on convenience copying-- the need for one or two or several copies of a document, which, of course, eliminates somewhat the need for typing carbon copies. New developments include greatly reducing costs of machines through stepped-up speeds, improved processing and easier operation, bringing per-copy costs to the one-cent range of duplicating devices. Machine operations, too, have been simplified to the point where a few minutes of instruction will permit efficient operation--for executive or clerk alike. And the main focus appears to be in the dry-copy field for high-speed copying (such as the Xerox 2400) creates copies at the rate of 2,400 per hour.[17]

The principal problem of copier choice and use would seem to be the proper control of the machine, the waste from its overuse or misuse, and the temptation to use it for personal or extra copies.

Dictating-Transcribing Machines--Consider, for a moment, this study in contrasts. The modern businessman, dictating from two to ten letters a day, buzzes for his secretary to give her dictation or "flicks" on his dictating machine and composes a message. This same communication job is now routine in business, industry, education, and government.

Compare this common machine application with the techniques used in an earlier day, the time of Disraeli

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[15] Alan Drattell, "Making Paper Work," Business Automation, (February, 1967), p. 26.

[16] "Copying, Duplicating and Printing," Dun's Review and Modern Industry (September, 1965), p. 143.

[17] Dun's Review and Modern Industry, Ibid., p. 195.

(1804-1881), the eminent British writer and statesman. Disraeli wrote half a dozen novels, made hundreds of speeches, sent thousands of dispatches to his colleagues in Parliament, and wrote innumerable articles in newspapers and magazines. He accomplished this titanic recording feat in a manner that is incomprehensible to us today, by writing everything himself in longhand. No machines were available for dictation, no typewriters for composition, no mechanical devices of any kind to speed up the recording process.[18]

Perhaps it's unfair or unwise to compare Disraeli, a masterful organizer-thinker-writer, with today's businessman. Yet it does serve a useful purpose to show that the busy man, properly organized, can do more--more dictating, more writing, in short, more work. Today's busy executive seems to prefer dictating machines in increasing numbers.

Latest figures available show dictating machine sales to be zooming. In fact, over 300,000 such units were sold in 1966.[19] Due to improvements in machine engineering, these important improvements in dictating-transcribing machines have been made:

1. Miniaturization techniques have been introduced, some machines so small that they can be carried in a shirt pocket.

2. Battery-powered portable machines are now appearing.

3. Transcribing equipment is becoming more centralized. Examples: desk telephones or special telephone-like units for dialing a central dictation pool where a machine automatically records his voice.

4. Machines are appearing completely transistorized; several now use a magnetic belt as the recording medium, built-in microphones and other dictating conveniences.[20]

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[18] Herbert R. Mayes, "Trade Winds," Saturday Review (December 30, 1967). p. 7.

[19] Administrative Management, Vol. XXIX, No. I (January, 1968), p. 24.

[20] Kendall August, "Office Technology: The Big Leap Forward," Dun's Review and Modern Industry (Special Report on the Office, September, 1964), pp. 163-164.

Still the ideal has not yet been reached: a machine that you can talk into which will provide a typed copy of the dictated message.

Microrecording Equipment--Microfilm gains in frequency of use as storage space for records becomes more precious. But what is not yet obvious to the layman are the many "faces" that the microrecording of records has taken. In fact, there are so many different forms of microphotography of records that the new generic term has switched from "microfilm" to "microform."

Typical of the trends in the microrecording of business records are these:

1. Microfilm has competition from such other new members of the microform family as:

   microfiche: microfilmed images recorded on a single card of transparent material
   aperture cards: punched cards containing film chips
   micro-jackets: transparent jackets with pockets which house either film strips or chips
   micro-opaques: imprints of film on a card
   videotape: magnetic tape used for records storage

2. New equipment now permits:

   easier insertion of the film into the reader, e.g., by cartridge
   easier location of the desired frame
   easier use of the record, such as instant printout of a hard copy of the record

3. New uses of microrecords (besides space savings) are now evident:

   They are easier to copy-film (make extra copies of the film).
   Postal savings allow big catalogs and directories and engineering drawings, for example, to be mailed for the same cost as an ordinary first-class letter.[21]

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[21] John Medlin, "A New View of Microfilm's Role in Communications," Administrative Management, Vol. XXVIII, No. 5 (May, 1967), p. 70.

4. Equipment (e.g., readers) is being reduced in price, making it available for the smaller-scale user. Many microform readers, too, are portable.

5. Colored records can now be microfilmed in color, lending a control dimension to the storage and retrieval of records.

6. Probably the trend with the most potential for microrecording is that which permits microfilming and the electronic computer to merge their functions of storing and retrieving records, although such a merger is in its infancy. Some observations on the use of microrecords in information storage and retrieval will be found in the section on "Data Processing Machines."

Other Office Equipment--One of the largest volume operations in today's office is the mailing function. And it, too, is reaping the harvest of mechanization. For example, one can now find these machine applications in the mail-room:

1. A machine that will apply address labels, heat-transferred addresses, or postage stamps to 7,500 pieces of mail in an hour.

2. A machine which photoelectrically scans identifying marks (codes) on the label forms to separate bulk mail by city or state.

3. A machine capable of applying EDP-imprinted, self-adhesive labels to envelopes at speeds up to 6,600 an hour.

4. A machine permitting punched cards to double as addressing plates without the need for additional processes or storage facilities.

5. A machine which combines EDP (electronic data processing) decision-making with mail insertion.

6. A machine with an electronic selector that reads instructions from punched statement cards or remittance cards, and chooses among several types of enclosures to insert with that statement.

7. A machine which addresses mail from stencils at the rate of 7,000 per hour.[22]

These developments and machine trends, while not all inclusive, clearly show the general office machines role is holding its own against the large-scale computerized systems. This trend is expected to continue well into the next decade.

DATA PROCESSING MACHINES

It is becoming common practice to refer to office work as "data processing" since the primary purpose of the office staff is to handle (and normally this means "process") data or information. If this statement is true, then all office machines, from simple to complex, could actually be considered as "data processing machines."

For the layman, however--and this may still include the majority of the reading audience--"data processing" is closely linked with those relatively complex machines associated with high-speed, large-volume, standardized processing of data. This connotation of data processing is observed in this section of the paper where the term refers to machines, whether operation in isolation, or in concert with others. Such machines include the following hardware:

1. punched-card equipment (unit-record machines)
2. integrated data processing equipment
3. source data automation (including optical scanners)
4. electronic data processing equipment (centered around the computer)
5. data communications
6. information retrieval

A brief section will be devoted to these six types of office hardware in the ensuing pages.

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[22] "General Office Machines," Dun's Review and Modern Industry (September, 1965), pp. 190-192.

Punched-Card Equipment

Above the general-office machines level is a set of machines that operate at speeds beyond the ability of the human operator to perform. These machines operate with a special machine language code (the punched hole) and in a compatible form in which the record (the punched card) is "acceptable" and usable in all the machines in the same electro-mechanical machine family. Sometimes these machines are called unit record machines since each punched card records but one transaction unit. When they are called "tabulating machines," this term refers to the fact that their end goal is the tabulation of columns of data.

The punched-card family or system of machines is essentially simple in concept. After the data are converted into machine language on the card-punch machine, the cards are normally sorted into alphabetic or numeric order. Frequently all that is done next is to print out on a tabulator (or accounting machine) a decoded listing of all or part of the contents of the sorted cards. Naturally many other machine functions are available on punched-card machines, and this list of functions continues to grow.

The key machine functions and machines in a punched card system appear below:[23]

Function:	INPUT	PROCESSING	OUTPUT
Machines:	Card (key) punch Verifier	Accounting machine Calculator Sorter Collator Interpreter Reproducer	Accumulating punch Summary punch Printing unit of accounting machine

For the last half-century, the punched card has been the principal medium of machine language for the processing of information. Until recently, its predominance remained almost unchallenged. New developments, especially those connected with the computer, have had a marked effect on the punched-card role, to some extent reducing its importance, but probably not to a dangerous extent.

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[23] Wallace M. Carrithers and Ernest H. Weinwurm, Business Information and Accounting Systems (Columbus, Ohio: Charles E. Merrill Books Inc, 1967), p. 158.

The advantages of the punched-card have been obvious. The card performs two major functions: 1) it serves as a medium of data storage; and 2) it introduces data into the machines for processing since the punched data can be used again and again for a variety of purposes.[24] Probably its strongest role today is that of peripheral equipment, that is, equipment supporting the computer. It is still the key machine for recording data in machinable form (on the keypunch) and its other workhorse machines work harder than ever to rearrange (the sorter) and print out (the accounting machine) data that have relevance to an EPD system.

Medium- to small-scale operations, ones not justifying a computer, continue to look to punched-card machines for fast processing of data. And new technological improvements in other areas such as the Dataphone (see Data Communications) also employ the punched card concept in the processing of data.

Source Data Automation

If you want speedy processing of data by machine, you must adapt your data so that a machine can read (or recognize) it for processing. Typically, this has meant that the data had to be converted to punched holes or their equivalent. This input phase, that is, the entry of data into the system, has largely been a manual operation, that is manually keying in the data on a typewriter-like keyboard. Through program control, however, some of these operations (such as automatic skipping, automatic shifting, and automatic duplicating) were programmed in advance and thus performed by the machine, operating independent of the operator.

Still the biggest bottleneck in the automatic processing of information by machine has been the input of data. "Why can't this phase of the operation be made automatic?" is a frequent question.

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[24] *Ibid.*, p. 156.

Each year a more concerted effort is made to solve the dilemma of mechanizing the data recording at the source (that is, where the data enter the system). In fact, a new term has been coined which relates to this idea: source data automation (SDA).

Source data automation has been called "catching data as it comes in the front door." It is the first rung of the ladder to EDP, IDP, RDC (remote data collection). Many examples of SDA abound: utility bills for householders; optically scanned credit cards; billing slips imprinted with codes at the time of the transaction for later optical scanning; punched card bills produced from the machine writing on a charge slip; clothing-stores tags identifying the price, the item which can be machine read and the data punched into cards or tape for further use. MICR (magnetic-ink character recognition) codes used on bank checks are also examples of SDA.[25]

Recently new SDA equipment has been developed to capture information at the first writing. Such examples are listed below:

portable card punch (which will fit into a glove compartment)
magnetic-ink character recognition readers
paper tape by-products in typewriting and bookkeeping operations
use of the typewriter for input and output to a computer
optical scanners

Optical Character Recognition (OCR)

Optical scanning, a popular term for OCR, is gaining in popularity among computer users as a fast, accurate, less costly computer input technique. In its most common application, OCR uses optical readers which are machines that can read typed or printed characters directly from documents. As such, these documents bypass the keypunching operation and thereby reduce the bottlenecks of batch processing and the errors of document reading and keypunching operations.

At present there are a number of OCR products on the market. They range from bar code and mark sense

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[25] Raymond H. Eckenbach, "The Many Faces of SDA," Business Automation, Vol. 12, No. 12 (December, 1965), pp. 33-34.

(machine-readable pencil marks) to journal tape readers, styled font-line and page readers to the more sophisticated multifont and hand-printed character readers. (A font usually represents a frame on which a particular printing style is imposed for printing or reading of characters.) At the present time, both alphabetic and numeric characters can be read by machine, although certain precise specifications must be found in the characters to be machine scanned. Successful experiments seem to be progressing for scanning handwritten material as well.

Frequently the question is asked about the effect of scanning equipment on the keypunch operator. Typical, perhaps, is the application of the Social Security Administration's custom-made OCR system, an IBM 1975, which will do the work of 120 to 140 keypunch operators. In this installation, about a quarter million lines of data, contained on a stack of forms four feet high, can be read and recorded on tape in slightly more than eight hours. Manual keying of the same amount of data into punched cards would likely take a keypunch operator more than 100 days.[26] The agency, however, says that no one will lose his job as a result of introducing the scanners as the keypunch operators will be reassigned to other recordkeeping operations.

Integrated Data Processing (IDP)

Frequently the term "IDP" is used, though sometimes in error. The difficulty in usage stems from problems with the connotations of the word "integrated." Originally, its use was coined by H.F. van Gorder in 1954 who defined it this way:

1. Original data are recorded at their point of origin in mechanical form;

2. Once in mechanical form, data are processed exclusively in a mechanical manner;

3. All processing of data is integrated so that original data in mechanical form serve all subsequent applications.

This last point--the mechanical handling of given data without manual intervention to typewrite or handwrite or key punch or figure or otherwise "process" the original data--truly signifies IDP.

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[26] Alan Drattell, "Scanning the World of OCR," Business Automation, Vol. 15, No. 1 (January, 1968), pp. 32-38.

IDP relates to common-language interchange of machines. It involves machines that operate from and/or create punched paper tape in 5-, 6-, or 8-channel code; edge-punched cards with the same codes; and punched or tabulating cards. And it comprehends or is compatible with computers as well, because the language of other machines can be translated into theirs also.[27] Perhaps the most widely known IDP machine is the Flexowriter, a typewriter-like machine which produces business documents and simultaneously punches a tape containing all or selected portions of the information. Other related machines employing the same IDP principles are available. Developments in IDP, on the whole, tend to receive much less attention than computers inasmuch as their results are less glamorous and earthshaking than is true of computers and related systems equipment having broader, more revolutionary applications.

Electronic Data Processing (EDP)

Electronic computers are the most recent and the most spectacular development in the history of office machines.[28] In a short decade and a half, three generations of machines have been developed. From vacuum tubes, to transistors, and now to the third stage of integrated circuits, computers continue to revolutionize the handling of information in an increasing number of applications. From the clerical handling of data (such as payroll) their applications have passed to more sophisticated uses, such as managerial decision making employing the use of mathematical models and operations research.

While engineering improvements have been effected in terms of computer storage, access time, speed of operation, and the like, it is in the new systems uses that the most impact has been, and will continue to be, made. Typical of these monumental improvements are the following, some of which are not yet in full-scale operation:

1. Real-time systems (using the computer to record transactions and adjust data

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[27] "Integrated Data Processing," (Dayton, Ohio: The Standard Register Company, undated).

[28] Carrithers and Weinwurm, *op. cit.*, p. 165.

maintained as the event or transaction occurs; e.g., the airlines' reservation system).

2. Time-sharing (identified as multi-programming, on-line interaction and real-time response). Actually, a time-sharing computer system can process a number of jobs at the same time. The machine "interleaves" jobs. In essence, the computer has been programmed to keep itself busy.[29]

3. A merger of computer and communication facilities (See Data Communications).

4. Development of centralized data banks for storing information which are able to use data communication facilities for transmitting information that is then processed, stored, and retrieved by computer.

5. Development of information utilities on a mechanized basis (e.g., a mechanized statewide credit bureau).

6. Visual and graphic displays of information. Computers now produce charts and graphs for decision makers in business. This new capability eliminates study and analysis of printed computer data and speeds up the reduction of data to graphic form. It does, in fact, bypass manual plotting and charting, a very time-consuming process. Frequent uses permit managers to compare current performances with forecasts and spot short- and long-term trends.[30]

7. Widespread linkup of computers and terminal (typewriter-like) devices in small offices. Just a card, a code, and a transmitting machine link many small offices with computer installations.

8. Software improvements so that less time is required to program the computer and more time can be given to the problems.

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[29] James R. Ziegler, "How to Prepare for Time Sharing," Business Automation, Vol. 15, No. 1 (January, 1968), p. 46.

[30] James L. Pyle, "Digital Plotting in Business," Datamation, Vol. XIII, No. 7 (July, 1967), p. 31.

9. Using the computer to retrieve information.

10. Expanded use of the computer in service bureaus. The customers buy computer time, and have their data processed for a fee. This trend, together with No. 7 above has brought the computer down to the point where its use can be profitably considered by small business. In effect, if they can't own one or rent one, they can at least rent time on the computer and share in its power.

Basically, the computer continues to take over more of the monotony of man's work with information. Its effects then reach into philosophy, sociology, and the humanities, as well as the more obvious engineering and economics. Toynbee expresses his feelings about the new dimension presented by the computer:

> This opens up an encouraging prospect of the service that science and technology may be going to do for the humanities. When, after programming a computer, its human attendant turns on the switch, this might look like an abdiction of the human mind in favor of a robot. But the mind, not the machine, has the last word. The machine is not the mind's soulless master; it is its soulless but obedient and industrious servant. So, far from upsurping the mind's place, the machine makes it possible for the mind to know and understand things that, in the pre-computer age, were beyond the mind's reach.[31]

Data Communications

In any information system, data must be processed for us, and usually the user is not the processor. For example, a clerk types a report to be used by his department head. After processing (typing) the data, the clerk sends (or moves) the information to the user. This movement of information by electronic means has led to the development of a new "information" term, data communications.

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[31] Arnold J. Toynbee, "New Windows into History," Business Automation, Vol. 13, No. 1 (January, 1966), p. 38.

Data communications is the marriage of data processing with communication facilities. Usually this means using the computer as a major processor in the communication system. But not always.

Some examples of data communication developments of the past decade follow:

> *Data-phone service*--business machines "talk" to to one another over regular telephone lines.
>
> *WATS* (wide-area telephone service) brings economical communication rates to high-volume users.
>
> *Telpak*--A private line service that provides communication capabilities for large-volume point-to-point transmission of voice, data, and other forms of communication.
>
> *The on-line real-time system*--a computer-based system which is available instantly to a remote user by data communications lines.

With data communications, the distance factor has been eliminated from the picture as a significant problem in managing an organization. Some of the far-flung ramifications of data communications are outlined in a recent publication of the American Telephone and Telegraph Company, Data Communications in Business: An Introduction, available from local telephone companies. A study of this book puts the data processing-systems-communications trio in proper perspective as well as introduces the businessman and business educator to a whole new field of study and promise.

Information Retrieval

Usually information is stored or filed for later retrieval. The traditional method of storage has used the unit record or document for storage by hand. With the expanding volume of data to be stored, however, it has become necessary, and possible, to use machines to store and retrieve information.

We now have the ability to develop information retrieval systems using punched cards or computers with magnetic tape or random access discs for information storage. Drawings and other graphic information can be stored in microimage form on aperture cards (punched cards with apertures or holes for inserting a frame of microfilm) and filed, merged, sorted, and retrieved on existing punched card equipment.[32]

At this point, the principal problem in automated information retrieval is intellectual, not technological. Man has yet to develop a well-accepted, well-functioning index system for classifying the information that is to be stored for retrieval. Until this is accomplished, machine retrieval is indeed limited.

INFORMATION TECHNOLOGY AND THE FUTURE

The technology for handling information has grown at a cataclysmic rate. Although the developments of the past two decades have had their major impact on large-scale organizations, the future promises to send such technology into every home and every office, regardless of size.

Diebold,[33] an automation pioneer, suggests these likely possibilities:

1. Language translation by machine.
2. Increased computer capabilities reducing greatly the cost of completing a typical data-processing job.
3. Cost of storage by magnetic tape and image storage greatly reduced.
4. Technological problems which incite human problems such as fear and uneasiness in the light of change; questions of education; questions of identification with an enterprise; with a profession; new questions about how to manage with machines.
5. Computer-based educational systems (and the attendant problems of developing a dynamic relationship between a student and a machine system).

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[32] John H. Veyette Jr., "Information Retrieval Systems," Systems, Vol. 7, No. 7 (July, 1966), p. 18.

[33] John Diebold, "The New World Coming," Saturday Review (July 23, 1966), p. 17.

As one looks back into history in order to understand the present and plan the future, he must be impressed by the orderly progress and constant change that has occurred. During the past century these periods stand out clearly regarding the introduction and use of machines in the office:

The first period--the growth of manually operated equipment (e.g., typewriters, cash registers, adding and calculating machines) whose operating speed was limited by the efficiency of the operator but was raised considerably through the addition of electricity.

The second period--in some ways starting alongside the first, stressed the more complex punched-card system where data were converted into a new machine language. In this case speeds far in excess of those attained by human operators was possible, and a wide variety of single-function machines was designed. During the ensuing decades came a great expansion of the tabulating family of machines culminating in the third period and the electronic computer.[34]

The process of creating information and putting it into the hands of the proper person is no longer a simple task. With the advent of more machines and greatly improved machine systems, man has found his function in the office changing. As Diebold has so well stated:

> If there is one salient fact about information technology, it is that it is going to produce enormous social change. As the quality of life is changed, as the rate of learning, information, travel, and communications all change, we will see a major change in living patterns, in hopes and desires. In short, a complete new environment will exist.[35]

It is your responsibility--and mine--to prepare for that environment. In this environment machines and man will have a new interface; each will play a significant part.

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[34] Carrithers and Weinwurm, op. cit., p. 164.

[35] John Diebold, op. cit., p. 18.

V

SOFTWARE: TRENDS IN DEVELOPMENTS

W. M. Carrithers, Business Information and Accounting System, A. B. Dick, Chicago, Illinois

At year-end 1967, there was complete agreement within a select group of leading administrative managers that the following were among the most significant recent office developments:

1. Computers and other electronic means of making large amounts of data quickly available...
2. Copying and duplicating equipment, particularly the electrostatic copier.
3. The growth of in-house training facilities, and the importance attached to training[1].

It is not surprising, but is quite significant, that hardware for the purpose of processing data and communicating information was recognized, together with training.

In a current brochure, a leading management training association states: "... you are operating in an environment technized by the computer. Disagreements among experts on pros and cons of computer capability have merely shifted the focus of argument from hardware to software."[2]

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[1] "The Ten 'Most Significant' Postwar Office Developments," Administrative Management, (January 1968), p. 34.

Among the most significant findings in a recent survey of a group of "front-line" managers, as reported late in 1967 by Research Institute, was that the supervisors believe these to be two of their most difficult problems for 1968:

1. Getting and keeping qualified help in today's tight labor market.
2. Understanding the new, complex equipment and upgrading the technological skills of operators.[3]

These opinions highlight the current situation, in accordance with my own views, that:

1. We need better balance between hardware and software developments; and-
2. We urgently need to train more people more effectively to apply software that is already available or emerging; and that-
3. Unless these things are attended to, managers will be unable to secure satisfactory returns from their ever-increasing investments in hardware.

SOFTWARE DEFINED AND AMPLIFIED

Although "software" has been defined,[4] it needs redefinition. At this time, it is almost always used to designate the non-hardware and the non-people elements of those data processing systems which incorporate computers, or are computer related. This seems to be too restrictive, in general, because a very large number of such systems do not depend upon a computer as the hardware element. Specifically, for the purpose of this article, it is necessary to enlarge the concept of "software."

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[2] "The Computer and You: new perspectives on management information systems" (14th Annual EDP Conference announcement), American Management Association, (March 4-6, 1968).

[3] "Report to Members," Research Institute of America, (October 24, 1967).

[4] Random House Dictionary of the English Language, (1st printing, 1966) has this definition: "n. Computer Technol. any of the written programs, flow charts, etc., including general subroutines, that may be inserted in computer programs."

In the book, Management Uses of the Computer, it is suggested that: "In its broadest sense, a computer is any system that can accept information, process it, and produce meaningful results."[5] For present purposes, acceptance of this thought provides the basis for a adequate broadening which allows software to be defined as:

1. *Computer related*--The programs that direct the computer to:
    a. Write other programs
    b. Perform standard processing operations such as sorting, merging, statistical analysis and report generation
    c. Solve the special problems encountered in non-standard applications, as well as handle adapted "standard" applications such as payroll processing and accounts receivable
    d. Supervise and/or operate the execution of input/output operations, schedule the carrying out of application programs and "act as traffic clerk for all computer operations."
2. *Other*--
    a. Procedures, detailed in charts and instructions, governing the operation of equipment (other than computers) to accomplish designated tasks including information gathering, processing, recording and reporting
    b. Forms and other non-hardware items that help to capture and convey data, or that are used to design and produce other software items.

SOFTWARE VIS-A-VIS HARDWARE DEVELOPMENT

Historically, especially with respect to computers, almost all hardware has been developed earlier than the related software. This is true of both mainframe and peripheral equipment. This is no isolated phenomenon in the office or information-handling organization. Man has always been able to develop more powerful (and complex) tools to meet all sorts of new needs, but then has had to learn how to use them effectively and widely. A current example is optical character recognition (OCR) capability. The need for faster, less expensive transfer of data at the input stage than is possible through manual keypunching has long been recognized. The hardware, optical readers, is available as are devices for writing the characters so they can be read reliably. Yet, aside from a few highly successful specialized applications such as in marketing petroleum products, there is not very much software for the average potential user.

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[5] Irving I. Solomon and Laurence O. Weingart, Management Uses of the Computer (New York: Harper & Row, 1966), p. 7.

The lag of software development behind hardware is likely to continue. It is costly for manufacturers to create and market software. Maintenance of proprietary rights to software is an unresolved issue. In most cases the hardware must exist, even if not perfected, so that software can be developed, tested, and demonstrated. But, fortunately for the earlier users who sustain the costs of software delays, the time gap is being narrowed. For example, a computer usage consultant just finished preparing a third-generation system and the programs to implement a badly needed, modernized production planning and control system for a medium-size manufacturer. The programming cost was substantially increased because the consultant found that a publicized standard program package was then unavailable and had to bridge the gap with time-consuming original programming.

Hardware manufacturers do recognize, however, that the VALUE: COST RATIO will be unsatisfactory to the user until adequate software is available and there are people trained to use it properly. Users will find it necessary, as hardware investments (or rentals) continue to increase rapidly, to insist on the minimum assurance that basic software will be available upon installation of the equipment. In fact, this concurrent availability is used by many manufacturers in their sales efforts and advertising support at this time.

These observations on software vis-a-vis hardware have been largely computer related. They are a applicable as well to:

1. Keyboard electric (or electronic) accounting and other key activated devices
2. Rapid addressing and labelling machines

3. Duplicating-copying machines and related equipments such as paper folders and collators
4. Data and facsimile transmission systems
5. Optical scanners and other character recognition equipment
6. Microfilm cameras and auxiliary equipment
7. Alphameric data display devices with keyboard input and computer compatability
8. Light-pen systems for making computer-aided designs
9. Other evolving tools that will have impact on man/machine operations

In view of the rapidity of these multiplex developments it is not surprising that the "how to use" know-how is still mostly in the hands of a relatively few, mostly self-trained, experts. There is now, and will be for a long time to come, a need for many more trained people who can:

1. Develop, test and market usable software,
2. Analyze operating problems and apply the available software.
3. In turn, help to train others to do these things.

TRENDS IN SOFTWARE DEVELOPMENT

As a guide to those concerned with developing the requisite technical education and vocational training, especially in the field of business and office occupations, it will be useful to recognize both general and specific trends in software development. Three general developments appear most significant.

First, there is acceleration in the rate of supply of efficient, although often complex, specific-system applications packages. These supplement the few that have existed for some time, such as payroll and labor cost accounting; they include such applications as business forecasting, credit approval and collection operations, engineering analyses of several varieties, financial analysis and the like. Modification of these packages to fit specific system situations is possible at considerable expense to the user despite systems engineering assistance contributed by the manufacturer. There are also many other specific-system programs that are wholly user-originated, were developed mostly in-house, and are usually non-transferable.

A second general development is the gradual, but mounting, emergence of general purpose software intended for a broad spectrum of users who do not possess a high degree of technical competence but who do know the information requirements of their own businesses. The sources of these systems packages are:

1. The hardware manufacturers, alone.
2. Manufacturers, assisted by users and/or by specialists in software design.
3. Software specialists, alone.[6]

Ordinarily, when the hardware manufacturer is involved, the user will be provided with the general purpose package without charge. This will not eliminate, however, substantial planning and programming expenses to arrange the necessary interfaces between the package and the unique parts of the application--and there usually is a need for this.

Third, it is encouraging to note that hardware manufacturers are rapidly acquiring companies and people with both creative and teaching abilities in order to produce and promote better software. This should provide, before too long, more adequate materials for educational efforts especially at secondary school and undergraduate college levels.

SPECIFIC SOFTWARE DEVELOPMENTS

There are also specific developments which may prove useful to note, especially when grouped as follows, with examples given:

TYPE 1--Utility packages, which are tools used by programmers to facilitate programming standard operations (e.g., sorting or merging) and input/output operations (e.g., card to tape, tape to printer). These are sometimes referred to as libraries of complete processing routines or subroutines. The functions covered include: organizing, modifying, manipulating, retrieving and presenting information in data file processing applications.[7]

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[6] Proliferating, usually small organizations, but currently absorbing quite a number of knowledgeable analysts and programmers from users' work forces.

[7] The author gratefully acknowledges the excellent discussion of these developments provided in Donald H. Sundeen's article, "General Purpose Software," which appeared in the January 1968 issure of Datamation magazine (New York: F. D. Thompson Publications).

TYPE 2 Complete input/output control systems (IOCS) such as the Univac IMRADS (Information Management Retrieval and Dissemination System) and Mark IV for the IBM System/360. Such programs in real-time digital systems permit the processing of different sets of data with different program routines at the same time or with minimum changeover time.

TYPE 3 Resident operating systems (which may include IOCS) that permit programmers and operators to plan and carry out multiple applications with minimal human intervention. Examples range from the early NCR 315 BEST (Business EDP Systems Technique) to ASI-ST which is a recent proprietary third generation information management system developed by Applications Softwear, Inc., and directed at the user who is a non-programmer.

TYPE 4 Time-shared executive systems such a Scientific Data Systems' MANAGE and System Development Corporation's TDMS (Time-Shared Data Management System). The objective of such user-oriented applications software is to allow non-technical users to employ effectively the services of independent time-sharing computer utility companies by means of remote access stations (terminals). Such service is already available in ten major cites and from several different companies.

The conclusion that can, hopefully, be drawn from the foregoing is that users will be able, before too long, to employ systems designers and machine operators who have been trained in the use of software that is easier to apply, rather than in the intricacies of programming. Then more energy can be constructively applied to systems analysis and improvement and not so much to tedious detail. Whether or not this is an expression of wishful thinking remains to be seen.

FUTURE SOFTWARE DEVELOPMENTS AND OTHER NEEDS

It is very necessary that future computer-related software developments be directed toward helping to break the existing bottleneck created by the serious shortage of analysts and programmers. The need is great for even more flexible program packages that can be readily applied to widely different operating areas. Then, as indicated above, the productive efforts of trained people can be applied to the design of information systems that will genuinely contribute to greater operating effectiveness.

THE PEOPLE GAP

To supplement the emerging hardware-software elements, other improvements need to be generated to assist in closing the "people lag" gap. This gap has, it appears, been caused by a number of circumstances including:

1. Excessive job specialization in such narrow areas as forms design, clerical methods, work measurement, filing and records retention, and the like.
2. In-plant training programs that are too limited in quantity and quality; as well as little or no job rotation.
3. Managements' failures to challenge educators sufficiently to provide improved education for office-type jobs; as well as failure to offer help, such as practical experience, and funds and services, in developing adequate education and training.
4. Insufficient expenditure of effort on reeducation and continuing education, especially of older employees.

ORGANIZATIONAL ARRANGEMENTS

A major share of responsibility for the "people lag" is due to perpetuation of organizational arrangements that are no longer adequate. In most enterprises today the responsibilities for information management are either not formally recognized at all or are assigned to another functional responsibility (perhaps to more than one) as an added duty. Of necessity, the information management assignment is often performed as a part-time duty. For example, a recent survey by Booz, Allen & Hamilton, consultants to management, shows that the "top computer executive" reports to a financial executive in 58% of the companies surveyed.[8] The minimum implications of this are that accounting operations and financially essential information processing will receive priority. More importantly, the specialized activities comprising information management will not receive adequate top management support in competition with more familiar functional assignments. In a number of large companies this has already been recognized with the result that:

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[8] Neal Dean, "The Computer Comes of Age," Harvard Business Review (January-February 1968).

1. An "administrative management" executive has been put in the structure at a sufficiently high level, with the major assignment of effective information management throughout the enterprise.

2. Separate computer hardware and the essential software have been provided for functions such as research and product development, operations research, manufacturing planning and control, and machine-tool numerical control programming--but only when the VALUE : COST RATIO appears to support such separate facilities.

Effective information management requires the full attention of a competent executive, especially as in-plant training and meaningful cooperation with educators is essential. Responsibilities could include not only systems and data processing but also a major share of planning and operating communications. As Peter Drucker has pointed out, "Throughout the ages the problem has always been how to get 'communication' out of 'information'." He also asserts that, "The more we automate information handling, the more we will have to create opportunities for effective communication."[9] It should be carefully noted that input communications are just as essential as the output of information for decision making.

NEW TECHNIQUES

Another need that is being recognized currently is for increased use of relatively recently introduced techniques for systems analysis and business problem solving. These include: operations research (O. R.), linear programming, queuing theory, gaming theory, decision theory (tables and trees), network diagramming, Critical Path Method, (PERT) and the like. It is not within the scope of this article to describe these techniques, nor how they may be applied to problem solving. At first glance it may seem that the mathematics required are beyond the capabilities of the available trainees; however, fortunately, it seems that ways are being developed to familiarize problem solvers with other approaches--often through the use of tables, charts and graphs--in order to work around the lack of high-level mathematical ability.

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[9] Peter F. Drucker, The Effective Executive (New York: Harper & Row, 1966-67), pp. 67-68.

Use of consultants for both guidance and training is still another approach. For example, a trained operations researcher with a broad knowledge of many different scientific techniques, as well as a mastery of probability statistics, differential equations, calculus, etc., will be required as a consultant--especially to know when to apply some of the techniques or to recognize when the complexity of the business problem is too great for a mathematical approach. In the course of his specific consulting assignment, the consultant can also train the client's system people so that they can secure additional practical applications.

Evidence of the growing recognition that such mathematical techniques can be usefully employed is that universities are providing more mathematics courses for accounting students to equip them more adequately to solve modern business problems containing many variable factors.

Another group of techniques that are not relatively so dependent on higher mathematics can be intelligently applied by trained employees. These include: work sampling or measurement and distribution, machine loading and scheduling, methods improvement, work simplification, methods improvement, value analysis, statistical quality control, exception reporting, etc. In systems analysis, flow charting and "cook book" procedure instruction writing are two familiar and widely used techniques. Again, it is not possible to describe herein how to learn or apply these techniques.

Various types of seminars are widely available for training in many of the techniques mentioned above, including workshops in which participants share application experiences. Universities, associations, professional organizations, manufacturers and consultants offer these seminars. In meetings and in the literature they publish, associations of practitioners, both professional and amateur,[10] have been working hard with considerable succes to promote the wider use of both fundamental and advanced techniques for improving office-type operations. For example, the Systems and Procedures Association helps both the experienced and the novice systems man to exchange practical ideas and problem-solving experiences leading to better systems and procedures. Periodicals, such as Management Services, a publication of the American Institute of Certified Public Acountants, are concerned with planning, systems and controls, and contain a wealth of case studies on how to apply many of these techniques. Finally, it must be mentioned that manufacturers of hardware and forms (including duplicating masters) offer ingenious forms design tools, such as layout sheets and templates, to simplify the task and improve the quality of charts and forms design.

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[10] The distinction intended here is between those who offer their services to clients and those who are employees of a user enterprise.

DATA COMMUNICATION AND STANDARDIZATION

There is a rapidly increasing need for lower cost intercommunication between discrete information systems, especially those employing large storage devices and high-speed data processing. Some of these systems are "on line and real time," as in the banking industry, and some are "on line," as in airline reservations systems. Others are "off-line" systems employing batch processing. But all have the common characteristic of the need to "talk" data quickly, accurately, in common languages and at reasonable cost. This generates, in turn, the need for machines, supplies, and operating methods that facilitate data flow and eliminate translation, needless transcriptions, and other forms of waste.

Standardization is an important emerging area of intensified activity. Both business and governments, here and abroad, are collaborating to pursue the benefits of standardization. In this country, the United States of America Standards Institute (USASI) coordinates the effort and issues USA Standards for agreed upon items. For example, (copyright 1966) "Flowchart Symbols for Information Processing" (X3.5-1966) establishes symbols for use in the preparation of flowcharts for information processing systems, together with a number of terms and definitions that have yet to be considered and are, therefore, subject to change. Other areas of interest that are under study are:

1. Optical character recognition.
2. Codes and input/output transmission.

3. Programming languages.

4. Problem definition and analysis.

5. Data elements and characteristics.

More importance needs to be attached to the implications of the facts that the flow of data and the management of information do not recognize the traditional boundaries between the so-called "office" and other parts of the organization that are concerned with information. Most of the significant input data, as well as much of the information for management use, will be furnished by and delivered to "non-office" employees: production dispatchers, timekeepers, factory machine operators, warehousemen, truck drivers, sales and service representatives--together with their first-line supervisors--are the sorts of people on whom we are increasingly dependent for vital operating data. Ways must be found, soon, to make it easier and better for these people to report data more accurately and promptly; also for supervision to operate a more effective monitoring system so as to maintain the integrity of the data bases upon which further processing depends. There is need for both better hardware and better software (used here in the broadest sense) as well as for better ways to instruct and motivate many sorts of people. That operating management be involved with systems people in these efforts is essential from beginning to end of the systems design and implementation phases.

CONCERN FOR THE INDIVIDUAL

Concern with the effect on the individual of the rapidly spreading use of increasingly powerful hardware, especially the computer, has been widely expressed. This concern, it seems to me, is essential lest we mistakenly attempt to subordinate people to machines and neglect to safeguard the privacy of individuals. The author finds himself in complete agreement with the opinions recently expressed so well by a noted scientist-educator who said:

> My feeling is that the structural complexity of today's society, and the multitude of interactions that take place within it, are really straining the ability of each of us to comprehend and deal successfully with the variety of problems that confront us in our daily lives--as individuals, as members of working organizations,

> as citizens. I see the computer as the essential tool that can provide the intellectual assistance needed to make each of us more capable of dealing with these growing complexities of life.[11]

In the same interview, Dr. Fano also made the point that he thinks hardware and software cannot be designed by themselves without taking into close consideration the operation of the community that is served, and that it is important to devote technical resources to adapting computers to the needs, desires and idiosyncrasies of people, rather than vice versa.

The problem was also commented on by Charles F. Adams, chairman of the board, Raytheon Company, at a recent American Management Association Conference on "Administrative Management in the Electronic Era," in recognizing the effects of existing advances to cut down reaction and decision time and to improve the probability of selection of a correct course of action form a wider range of alternatives. Mr. Adams also pointed out that these advances "...place a premium on the difficult and intangible task of understanding and dealing with the needs of people in terms of their individual thoughts, motivations and aspirations."

Those who contribute to the creation and application of these powerful new hardware and software tools will probably be sufficiently challenged and adequately rewarded. But what about those what about those who, as operators, operate the equipment in accordance with plans and instructions prepared by others? These will be the problem people, lacking motivation except that which can be provided through adequate salaries and fringe benefits.

Perhaps the only real solution is education. As stated by Dr. Forrest Kirkpatrick: "keep education in the fore front (in an organization)...education would serve two purposes...it would release the strengths and resources of each individual through training and retraining . . . and orient employees to the world community . . ."[12]

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[11] Quoted from an interview with Dr. Robert M. Fano, Ford Professor of Engineering and Director, Project MAC, Massachusetts Institute of Technology, as printed in The General Electric FORUM, Vol. X, 0.4, (Winter 1967-68).

CONCLUSION

There is little doubt that business is ". . . poised on the edge of a futuristic era of superautomation."[13] Whether or not business can use the hardware and software that is available now and that will continue to emerge for the best interests of all concerned is not so certain.

The right solution can be had only through the synergetic efforts of man and machine. Human resource development is the key.

Education and training are prime requisites so that: ". . . man and his information systems will become an ever more creative force for progress at all levels of human society."[14] The greatest need is for, and the most satisfying rewards will come from, that TRAINING which best provides the capacity to OUTLOOK broadly together with the capability to INLOOK sufficiently.

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[12] Dr. Forrest Hunter Kirkpatrick, vice president and secretary, Wheeling Steel Corporation, "Partners for Tomorrow--Man and Machine," Business Automation (October, 1967), p. 37.

[13] Business Week (January 13, 1968), p. 54.

[14] J. Stanford Smith, "Man and Computer: The New Partnership," The General Electric Forum, Vol. X, No. 4, (Winter 1967-68).

VI

A PLAN FOR DEVELOPING A TAXONOMY OF OFFICE ACTIVITIES

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To develop and stabilize a classification which can be used as a common basis for analyzing the activities of office jobs. That is, the classification may be used to identify the common elements of all office jobs to arrange office activities on a simple-complex plane, and to allocate office activities learnings to the appropriate institution and age level. On this basis, it should be possible to project educational course content and up-date office training curricula, thus closing the knowledge-attitude gap between office education and employment.

PROBLEMS

For decades, vocational office business education curricula content has been based on assumptions, and limited observations. Today the primary emphasis in so-called office-training curricula is on typewriting, shorthand, some data processing, and on the development of manual skills. The initial phase of developing a more realistic curriculum base is the construction of a system for classifying office activities.

The primary purpose of this paper is, therefore, to specify a procedure for developing a classification system according to which all office activities can be identified and arranged in a hierarchical structure on a simple-complex plane.

Sub-problems

1. Any content analysis such as "office activities" is subject to a wide range of interpretations because of individual differences. A problem is to avoid slanting or tailoring descriptors to a specific population of users for example, research personnel or business educators; that is, to avoid selecting terms and descriptors which are not generally understood or accepted.
2. There is no single way to organize the entire universe of office activity terminology into an ordered and well-established pattern of relationships that is best for all users.
3. Time and use erode a classification. How will time and use affect the classification ultimately developed as the basis for this study? This is, how soon will this classification scheme become outmoded or fail to function usefully and therefore, how can the taxonomy be most generally conceived and what controls will contribute to maintaining its stability?

CRITERIA

The taxonomy should be structured with the following criteria in mind:

1. Titles and definitions should be generally acceptable to the total population to which the taxonomy will be applied but should not be slanted toward any one segment of this population.
2. Titles should be short and simple. Uniterms, keywords, or subject headings should be used.
3. The number of major classifications should be restricted in the interest of simplicity.
4. The main descriptors should allow for the exclusive classification of office activities without extensive cross reference.
5. The main descriptors should be broad subject headings that stand for an idea or concept and are chosen to facilitate grouping activities and retrieving information for the users.
6. Controls should be established which will inhibit the adverse effect of time and use on the terms. Definitions should be perfected for main descriptors and synonyms should be established for all terms so as to counteract

a general wearing away or weakening of the meaning of terms as originally applied.

A revision should be made after a trial use of the taxonomy to adjust to ambiguities. After this revision, no change should be made in the taxonomy during the data-gathering period. This will help to keep it a stable data-gathering vehicle.

7. The taxonomy should allow for accurate input and retrieval of data.
8. A decimal numeric pattern should be used in the taxonomy to identify homogenous groupings and to help stabilize it.

PROCEDURE

For developing and stabilizing a classification of office activities to be used as a device for collecting situations (examples) in an orderly manner so that they can be studied.

1. Determine a set of main descriptors (major categories, key words, uniterms) of from 10 to 15 items; no more than 15.

   Stabilize the main categories through a "jury" representing segments of the total population concerned with office activities or stabilize it somewhat arbitrarily by specialists in Business and Office Education, The Center for Vocational and Technical Education, The Ohio State University, Columbus, Ohio.

   If a jury is used, members should be selected from various office-oriented groups: National Business Education Association, Administrative Management Society (Work through national officers or committees; for example, Personnel Research Committee, chaired by F. W. Capper, Equitable Life Insurance Co., P. O. Box 1635, Des Moines, Iowa, 50306), Systems and Procedures Association, National Secretaries Association, American Records Management Association, Data Processing Association, and the American Accounting Association.

2. Determine a list of all possible related activities (elements) which are a part of every major category; that is, extract and accumulate words which describe office activities.

   This "laundry list" can be developed by members of the Business and Office Education Staff (CVTE, Ohio State) from dictionaries, thesauri, Dictionary of Occupational Titles, and business texts. The list should be exhaustive. It should be alphabetized in total, without relating the words to the descriptors.

3. Classify the activities (elements) according to the major categories.

   Send the list of major categories (with concise definitions of each) and an alphabetized list of 25 activities (only) to a random selection of the following population, getting 100 usable replies from each group to assure balance and democratic representation:

   a. Business education graduate students
   b. Members of the Administrative Management Society*
   c. Members of the Systems and Procedures Association
   d. Members of the National Secretaries Association
   e. Business teacher trainers (or business educators from the Talent Inventory)
   f. Members of the American Accounting Association
   g. Members of the American Records Management Association
   h. Members of the Data Processing Association
   i. Members of the Private Business Schools Association
   j. Office training coordinators (co-op programs)

   The above representation gives a total of 1,000 opinions about the categories into which the activities are to be sorted. Only 25 should be sent to each person because if more are sent, it is likely that interest and attention in making judgments will wane. If the total list of activities to be classified is so long that more than 1,000 "classifiers" are needed, each of the above 10 groups (a through j) should be increased by the same number (say from 100 to 125 each) so that the same balance is maintained among segments of the total population.

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*Work through National headquarters with all Associations.

The procedure suggested above does not have to result in a stratified sampling. It is possible that some groups should have greater weights than others but to determine these weights introduces the problem of controlled variances which seems like an unnecessary complication. The first procedure (balance segments) seems simpler.

Each participant should receive a letter of transmittal, a sheet of defined categories, and a list of 25 activities (alphabetized; can be any segment of the total list but in no way categorized). "Dear Mr. X, will you please indicate to which one of the categories indicated (and defined) you would relate each of these 25 activities." Be sure the participant understands that this is a forced-selection process. Each activity must be categorized into no more than one classification.

Let us look at a result. Let us assume that the activity was typewriting and that two of the categories were 1) Communicating, and 2) Recording. Fifty-five percent of those who participated in classifying this word said it belonged to category number 1; 42 percent, category number 2; and 3 percent said it did not fit into any one of the categories given.

Problem: What cut-off points should be used? Consider--

a. A minimum of 50 opinions about how each activity should be classified.

b. A plurality. If the "votes" are nearly a tie, more will have to be sought until a definite plurality (majority) is indicated.

   Or a testing procedure; i. e., a chi-square test so that when the responses are significantly different (.05 level) from chance, the classification of the activity is set.

4. Fix (stabilize) the final classification.

Once the categories for each activity have been determined (answers could be returned to the Center on punched cards especially designed for machine counting), the resulting taxonomy should remain unchanged throughout the data-gathering phase of the total research project, with the one possible exception of a few minor adjustments or clarifications resulting from the *trial run* of the data-gathering procedure. That is, to be useful, the classification (taxonomy) should be protected from the vicissitudes of individual differences.

5. Miscellaneous

Although the assignment was to suggest a procedure for "developing a taxonomy of office activities," one cannot help but think ahead to other phases of the total study. The following suggestions relating to them are contributed, therefore, for whatever they may be worth:

a. *Train* data collectors who will (after a test run) collect such items as the following from a representative sampling of types of office and types of office "jobs."

   1. Job title
   2. Age of employee
   3. Years of experience and nature of the experience
   4. Education
   5. Descriptions of situations (procedures or duties) in each of the jobs being studied which involve *one* activity term; and example of the use of the term in a "real" setting.

b. An example will usually involve any of the terms in the taxonomy since they are rightly co-related, but each example should be given *primary* identification according to the term being studied at the time. Multiple cross-referencings would be *secondary* identifications. This procedure is suggested for the sake of keeping order and for controlling the classification of the sample situations for later retrieval and study.

c. Hopefully, ten or more situations can be collected by in-the-field data collectors to illustrate each activity. These situations make up the main "data bank" from which we can then draw conclusions about the nature of office work, the types of activities which relate to different job classifications according to age of employee, experience, or education and which will help us identify new and improved office education curricula.

SUPPLEMENTARY MATERIAL

APPENDIX A

REPORT OF A MEETING ON THE EMERGENT OFFICE

The purpose of the meeting on the emergent office was to give selected representatives from industry and education an opportunity to consider together some of the implications of the new technology for office education. Industry's interest in office education stems from their need to acquire employees who can adapt their knowledge and training to new developments. Educators must consider these new developments when setting performance goals and considering curriculum revision. This consortium was planned with the idea of giving industrialists and educators a meeting place where they might discuss mutual problems.

NATURE OF THE GROUP

The group was comprised of nine representatives from industry and twenty educators. Representatives from industry were selected on the basis of their familiarity with and interest in the educational needs of their employees and the changes brought about by new hardware and software in the office. Educators who have knowledge of the use of new hardware in the emergent office as well as educational techniques were chosen to participate. This group created the desired atmosphere for candidly discussing problems of the current office, predicting future needs, and suggesting how education can meet the rapidly changing office environment.

MANPOWER REQUIREMENTS

The session was opened with the estimate that by 1975 probably one million more people will be needed in data processing occupations than are presently employed in that field. According to the present technology, one-half of these persons will be needed in the programming area; the other half will be performing supporting tasks of a more routine nature. These routine tasks lend peripheral support to computer activities and may be characterized as: 1) preparation of input, 2) control of machine operations, and 3) analysis, use, and distribution of output.

One company reported that it takes 1,250 clerical workers to support 250 programmers--a ratio of five to one. Prediction was also made that the growth of customer services made possible through the use of the computer will increase the number of middle management and clerical workers needed. Thus, the trend for an increasingly greater number of clerical workers is evident. This trend appears to be a contradiction to the often repeated prediction that clerical workers will decrease in numbers as programmers and automation-age processors increase.

EQUIPMENT TRENDS

A major portion of the conference time was devoted to a discussion of equipment trends for the emergent office. While it was found to be difficult to make exact predictions, some significant ideas were projected indicating that there will be refinements and developments in the computer technology field.

Many participants felt that significant changes will soon occur in computer input rates--the area in which there is the greatest need for control, speed, and accuracy. Industry believes that the present means of input, one keystroke at a time as on the keypunch machine, must be eliminated because of the human fallibility to make errors. While the principal hope for reducing the keying in of input lies with scanning devices, general consensus existed in the group that the keypunch machine will be with us in force for many years to come.

Developments in software may be one of the most feasible ways of making possible the improved use of hardware. Such developments will be especially important in the area of input and may replace the one-stroke-at-a-time entry method.

In order to eliminate errors caused by human fallibility, feedback and correcting devices are being built into computer equipment. An example of a feedback device is the automatic playback of information entered in a computer through the Touch-Tone system developed by the Bell Telephone Company.

The ability to tie hardware to a remote input device has made possible the development of on-line time-sharing use of computers. Greater use of on-line equipment will facilitate information processing for the small office as well as the large office. One participant expressed the opinion that on-line equipment is not a panacea for all the ills of information processing but that it does eliminate duplication in recording data. The data still must be recorded correctly at the point of entry. To illustrate further that the on-line concept may not be appropriate for all operations, one participant stated that less than 10% of jobs in his company needed the instant service provided by on-line equipment. In response to an educator's query about the extent of use of on-line equipment, one participant stated that recent figures project that 90% of computer use will be on line by 1975.

Other comments made were that the use of on-line equipment with input through a Touch-Tone device rather than the standard typewriter keyboard may eliminate somewhat the need for clerical help on the input operation since the executive himself may use the Touch-Tone equipment; another idea expressed was that the quantity of information produced through the speed and low unit cost of computer operation will add to the records management problem while the quality of information will add to problems in utilization.

A summary tabulation of some equipment trends indicated during the meeting are as follows:

- Increased application of the on-line, real-time principle
- Optical scanning for input, including a handwriting scanner
- Techniques for displaying input for visual verification
- Voice playback of input for verification
- Increased mechanized storage and retrieval of records
- Uniform computer language
- Voice input
- Touch-Tone input
- Miniaturization through solid state circuitry
- Integrated and monolithic circuits for improved input
- Card dialers

Increased use of mark sensing

MAJOR REQUIREMENTS FOR EFFICIENT JOB PERFORMANCE

The idea was developed that efficient work performance is based on the worker's conceptualization of the total task; that the worker should focus on the function rather than the hardware. The worker must understand that the hardware is a tool for getting the task done. He must be concerned with the processes involved in getting the right answer rather than the operation of the equipment.

Workers must be made aware of the need for accuracy of input and the existence of checkpoints and feedback devices for monitoring the accuracy of inputs.

INDUSTRIAL TRAINING PROGRAMS

The computer industry, in addition to giving training programs for their own employees, has numerous educational programs for managers and educators. These programs have been developed on the premise that "advancement of the state of the art" depends upon the ability to understand the use of the present equipment.

Descriptions of a number of educational programs were given by several of the participants. One company will offer, through Science Research Associates, opportunities for colleges to sponsor courses for mathematics and science teachers. SRA is also arranging two-day institutes for groups of 20-30 people. During the summer of 1968, three-week workshops will be conducted by one company for 1,000 teachers at 26 educational centers across the country.

Another company is developing a training kit to be used in classes organized for customers. The kit will take the learner through a series of systems problems with the use of slides, workbooks, and other materials. One company gives its employees a secretarial training program to help them develop a knowledge of computer terminology and corresponding shorthand symbols as well as knowledge of company objectives and systems. This program is based on the premise that employees already have basic shorthand and typewriting skills. Some companies also make computers available to schools at reduced cost and will instruct school personnel in the use of the computer.

EDUCATIONAL IMPLICATIONS

A number of educational implications emerged in a "give and take" discussion session among participants from education and industry.

Much discussion revolved around the question of whether a worker needs to conceptualize the entire information system of which his job is a small part or whether a worker needs to understand only his immediate task. Some industrial representatives felt textbooks were problem oriented rather than concept oriented. One educator stated that since most textbook authors are aware that people are more important than things and that concepts are more important than problems, they do try to incorporate these ideas in their textbooks. In addition, it was observed that problem solving is a pertinent tactic for concept development. A new high school accounting book which includes flow charting of a system incorporates the conceptual approach. Teachers must be aware of the desirability of using the conceptual approach to make effective use of new educational materials.

The errors the worker makes because of his misunderstanding of the system is an illustration of the need for teaching by the conceptual approach. On the other hand, one educator stressed that some young people may do a routine job well and be happy in their work; they are not capable of a high degree of conceptualization and may resist efforts to be taught concepts.

One industrial representative summarized the discussion by stating that there should not be an "either-or" approach to teaching conceptualization. Industry expects high school graduates to have appropriate attitudes, skills, and understandings.

The question was asked, "Should we teach 'data processing' as a single package?" The answer was "No." Data processing should be integrated into various subject-matter areas. Representatives from industry were in general agreement that students need to learn how to use data processing as a tool in the solution of business problems. If a student is taking a retailing course he should learn what machines will help him solve retailing problems.

One industrial representative stated that people with a fifth-grade reading level can perform some data processing jobs satisfactorily. Furthermore, there are one-quarter of a million jobs that these people could handle.

The gamut of data processing activities from simple operations like key punching to high level programming and computer design jobs suggests the desirability of task analysis that includes identification of the human aptitudes and abilities required for each task. Task analysis should be stated in behavioral terms that are suggestive of training experiences--not in the superficial descriptive terminology of the Dictionary of Occupational Titles. A task analysis should reveal those tasks which demand conceptualization and those routine tasks which do not.

A summary of educational implications for the emergent office includes the following items of interest to educators:

- Worker conceptualization of the total process versus worker conceptualization of the specific task
- Worker focus on function rather than on hardware
- Worker awareness of need for accuracy of input
- Worker willingness to make use of checkpoints and feedback devices to control accuracy
- Worker solution of problems through a conceptual approach
- Worker placement on job correlated with his ability level and degree of routineness of the job
- Worker realization that data processing is of value only in a problem solving context and therefore should not be used (or taught) as an entity in itself

APPENDIX B

DEFINITION OF TERMS FOR THE TAXONOMY OF OFFICE ACTIVITIES

Activity: An activity is a group of tasks occurring in close temporal proximity that have a common purpose.

Data: Data are the raw materials of the office used in the production of information.

Descriptors: Descriptors are nouns, adjectives, and modifiers that may be attached to a verb to form a task description.

Domain: A domain is one of the three sections (Operating, Interacting, and Managing) in the Taxonomy of Office Activities within which action verbs may be grouped.

Hardware: Hardware consists of the mechanical and electronic devices involved in data processing.

Information: Information is data that have been processed for use in decision making.

Interacting Domain: The interacting domain includes the categories of verbs which describe the interpersonal relationships involved in the performance of office tasks.

Job Analysis: A job analysis is an analytical and systematic study and observation of office workers performing office tasks.

Managing Domain: The managing domain includes the categories of verbs which describe the administering activities in which office workers are involved.

NOBELS: New Office and Business Education Learnings System is a proposed curriculum development project.

Operating Domain: The operating domain includes categories of verbs which describe the operations involved in the processing of data.

Operation: An operation is the processing element of an activity. Operations (processes) make up the divisions of the Operating Domain.

Performance Goal: A performance goal is a clearly defined objective that is stated in terms of the learner's behavior and which provides a criteria for the assessment of achievement.

Primary-Division Verbs: Primary-division verbs are those verbs which constitute the divisions of each of the three domains.

Related Verbs: Related verbs are those verbs which have approximately the same meaning as the secondary-division verbs. Related verbs are listed in parentheses beside the secondary-division verbs.

Secondary-Division verbs: Secondary-division verbs are those verbs which are listed under each of the primary-division verbs.

Software: Software in its restricted sense designates the non-hardware elements of data processing systems which are computer related; in a broader sense software includes not only computer-related programs but also procedures and forms to facilitate the gathering, processing, recording, and reporting of data.

Task: A task is the smallest unit of office work that has meaning within and of itself. Two or more tasks which occur in close proximity with a common purpose make up an activity.

Taxonomy: A taxonomy is an orderly classification system that provides for an identification of relationships.

APPENDIX C

INDEX OF VERBS FOR THE TAXONOMY OF OFFICE ACTIVITIES

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abridge I - 5.08
abstract I - 5.08
accelerate III - 3.03
accept II - 3.01
accommodate II - 3.02
accompany II - 2.05
accomplish III - 3.04
account for I - 13.04
accrue I - 2.01
accumulate I - 2.01
  I - 3.02
acknowledge II - 3.03
acquaint II - 2.09
acquiesce II - 3.01
acquire I - 3.03
actuate III - 3.0
adapt I - 8.01
  II - 3.02
  III - 3.01
adjust I - 8.01
  I - 13.04
  II - 3.02
  III - 3.01
admit II - 3.03
admonish III - 4.01
advise II - 2.01
advocate II - 1.25
  III - 4.08
affirm II - 1.01
affix I - 7.05
agree II - 3.01
aid II - 2.02
alert II - 2.03
alienate II - 3.31
allay II - 2.10
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allot III - 2.01
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allure II - 3.08
alter I - 8.01
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amend I - 8.10
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  III - 4.04
annotate I - 5.01
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anticipate III - 1.05
apologize II - 3.04
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apportion III - 2.01
appraise II - 2.06
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arrange I - 1.0
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assure II - 2.04
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authorize III - 4.02
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automate III - 2.03
automatize III - 2.03
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batch I - 1.01
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borrow I - 3.01
brag II - 3.07
brief II - 2.07
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camoflauge II - 3.06
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captivate II - 3.08

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cement	I - 7.05
censure	III - 4.01
centralize	III - 2.04
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charge out	I - 12.01
charm	II - 3.08
chart	I - 10.01
check	I - 13.02
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cheer	II - 2.04
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claim	II - 1.01
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clarify	II - 1.12
classify	III - 1.03
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	I - 9.06
clear	I - 9.06
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coach	II - 2.07
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	II - 3.10
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collaborate	II - 3.14
collate	I - 1.02
combine	I - 1.03
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comply	II - 3.01
	II - 3.23
compose	I - 5.0
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concur	II - 3.01
condense	I - 5.08
condemn	III - 4.03
condense	I - 8.04
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confer	II - 1.04
confess	II - 3.03
confirm	III - 4.02
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consent	II - 3.01
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constrain	II - 3.26
consult	II - 1.04
consume	I - 9.02
contend	II - 3.12
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convert	I - 8.02
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cooperate	II - 3.14
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cost	I - 2.16
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count	I - 2.06
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cross-balance	I - 2.07
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cross-reference	I - 6.02
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	I - 8.04
debate	II - 1.05
debit	I - 10.04
debug	I - 8.03
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decline	II - 3.27
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delete	I - 9.05
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deliver	I - 12.03
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demonstrate	II - 2.12
deny	II - 3.27
deplete	I - 9.02
deposit	I - 11.01
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design	I - 5.02
	III - 1.04
designate	III - 2.20
destroy	I - 9.03
	III - 2.08
detail	II - 1.08

determine percents	I - 2.10
determine ratios	I - 2.11
devise	I - 5.02 III - 1.04
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discard	I - 9.04
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disguise	II - 3.06
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dispense	I - 12.05
disperse	I - 12.07
display	I - 12.06
dispose of	I - 9.04
dispute	II - 1.05
disregard	II - 3.15
disseminate	I - 12.07
distinguish	I - 4.02
distribute	I - 12.07
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divulge	II - 1.24
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elicit	II - 1.10
eliminate	I - 9.05 III - 2.08
elucidate	II - 1.12
elude	II - 3.05
emphasize	II - 1.06 II - 1.11
empathize	II - 3.16
employ	III - 2.09
empower	III - 2.06
enchant	II - 3.08
encode	I - 6.04
encourage	II - 2.04
endure	II - 3.17
enforce	III - 3.02 III - 4.02
enlarge	I - 8.05
enlighten	II - 2.06
enter	I - 10.05
enumerate	I - 2.06 II - 1.08
equip	III - 2.10
eradicate	I - 7.04
erase	I - 7.04
escort	II - 2.05
establish	III - 3.05
esteem	II - 3.28
estimate	I - 2.13 III - 4.04
evade	II - 3.05
evaluate	III - 4.04
execute	III - 3.07
exceed	II - 3.18
excel	II - 3.18
exchange	I - 12.15 III - 4.10
exclude	I - 9.05
excuse	II - 3.19
exhibit	I - 12.06
expand	I - 8.05
expedite	III - 3.02
expend	I - 9.02
explain	II - 1.12 II - 2.07
express	II - 1.13
extend	I - 2.14
extract	I - 7.16
facsimile	I - 10.02
familiarize	II - 2.09
fascinate	II - 3.08
fasten	I - 7.05
feed	I - 7.06
feign	II - 3.06
file	I - 11.02
fill	I - 7.11 I - 11.05
fit	II - 3.02
fix	I - 7.07
fold	I - 7.08
follow	II - 3.23
foot	I - 2.18
forecast	III - 1.05
forestall	III - 4.07
forewarn	II - 2.03
forgive	II - 3.19
forward	I - 12.08
foster	II - 2.04
free	III - 2.07
fulfill	III - 3.04
furnish	III - 2.10
gain	I - 3.03
gather	I - 3.02
glue	I - 7.05
govern	III - 4.09
graph	I - 10.01
greet	II - 2.13

group III - 1.03
guard I - 11.03
hand over I - 11.03
handprint I - 10.08
handwrite I - 10.08
hasten III - 3.03
hear II - 1.16
hearten II - 2.04
heed II - 1.16
II - 3.23
help II - 2.02
hint II - 3.20
hire III - 2.09
hold I - 11.04
honor II - 3.28
hunt I - 3.08
ignore II - 3.15
illustrate I - 5.02
II - 2.12
impel III - 3.02
implement III - 3.04
impose III - 3.02
improve I - 8.10
improvise II - 3.21
inaugurate III - 3.05
increase I - 8.05
index I - 6.0
induce II - 1.19
III - 3.06
inform II - 2.06
initial I - 10.08
initiate III - 3.05
ink I - 7.09
innovate II - 3.22
inquire II - 1.14
inscribe I - 10.08
insinuate II - 3.20
inspect I - 13.02
inspire II - 2.04
III - 3.06
institute III - 3.05
instruct II - 2.07
integrate I - 1.02
intercede II - 2.08
interchange III - 4.10
interpose II - 2.08
interpret II - 1.12
interrogate II - 1.20
intervene II - 2.08
intimate II - 3.20
introduce III - 3.05
invent I - 5.02
invert I - 8.12
investigate I - 3.08
invite II - 1.15
isolate II - 3.31
issue I - 12.01
journalize I - 10.04
judge III - 4.04
junk I - 9.04
keep I - 11.04
label I - 6.05
laminate I - 7.10
launch III - 3.05
layoff III - 2.07
lay out I - 5.02
lead II - 2.05
lend I - 12.09
lengthen I - 8.05
lessen I - 8.04
let III - 4.06
limit I - 8.07
III - 4.05
listen II - 1.16
load I - 7.11
loan I - 12.09
lock I - 7.12
log I - 10.05
look for I - 3.08
maintain I - 11.03
manage III - 4.09
manipulate I - 7.0
mark I - 10.08
mark down I - 2.16
mark up I - 2.16
mark sense I - 10.08
match I - 4.03
maximize I - 8.05
measure I - 2.15
mediate II - 2.08
merge I - 1.02
mesmerize II - 3.08
mete out I - 12.05
microfilm I - 10.02
minimize I - 8.04
moderator I - 8.11
modify I - 8.0
III - 3.01
mollify II - 2.10
motivate II - 2.04
III - 3.06
move I - 12.03
name III - 2.02
narrate II - 1.07
negate I - 9.01
negotiate II - 1.17
notarize I - 13.05
notify II - 2.06
nullify I - 9.01
numbering I - 7.13
obey II - 3.23
obliterate I - 9.03
obtain I - 3.03
offset II - 3.11
OK III - 4.02
omit II - 3.15
open I - 7.14
oppose II - 3.12
order I - 1.05
I - 3.04

	II - 1.06
	III - 2.12
	III - 4.09
organize	III - 2.0
orient	II - 2.09
originate	I - 5.02
	III - 1.04
other	I - 1.06
	I - 2.19
	I - 3.10
	I - 4.04
	I - 5.10
	I - 6.06
	I - 7.25
	I - 8.13
	I - 9.07
	I - 10.09
	I - 11.06
	I - 12.16
	I - 13.06
	II - 1.28
	II - 2.14
	II - 3.33
	III - 1.06
	III - 2.13
	III - 3.09
	III - 4.12
outdo	II - 3.18
outfit	III - 2.10
outline	I - 5.06
outshine	II - 3.18
overlook	II - 3.15
oversee	III - 4.11
pacify	II - 2.10
pack	I - 7.15
package	I - 7.25
page	II - 1.18
paraphrase	I - 5.07
pardon	II - 3.19
participate	II - 3.29
partition	III - 1.03
pass on	I - 12.08
paste	I - 7.05
patch	I - 7.07
percentage	I - 2.10
perfect	I - 8.06
perforate	I - 7.17
perform	III - 3.07
permit	III - 4.06
persevere	II - 3.24
persist	II - 3.24
persuade	II - 1.19
	II - 3.10
"PERT"	III - 2.11
photograph	I - 10.02
pick	I - 3.09
piece	I - 7.07
pin	I - 7.05
placate	II - 2.10
plan	III - 1.0

plot	I - 10.01
polish	I - 7.02
	I - 8.06
poll	II - 1.03
post	I - 10.04
	I - 12.06
praise	II - 2.04
preclude	III - 4.07
predict	III - 1.05
prescribe	III - 4.08
preserve	I - 11.03
pretend	II - 3.06
prevent	III - 4.07
preview	I - 3.05
price	I - 2.16
print	I - 10.03
probe	I - 3.08
procure	I - 3.03
prognosticate	III - 1.05
program	III - 2.11
project	III - 1.05
prompt	III - 3.06
proofread	I - 13.03
prorate	I - 2.17
	III - 2.01
protect	I - 11.03
provide	I - 11.05
pry	II - 1.20
publicize	I - 12.10
pull	I - 7.16
punch	I - 7.17
purge	I - 9.0
qualify	I - 8.07
query	II - 1.14
question	II - 1.20
quiet	II - 2.10
quiz	II - 1.20
quote	II - 1.21
rank	I - 1.05
rate	I - 2.10
	III - 4.04
ratify	III - 4.02
rationalize	II - 3.25
reacquire	I - 3.06
rearrange	I - 8.10
	III - 3.01
reassure	II - 2.04
rebuke	III - 4.01
recapitulate	I - 5.08
	II - 1.26
receive	I - 3.03
reclaim	I - 8.09
recommend	II - 1.25
	III - 4.08
reconcile	I - 13.04
	II - 2.08
	II - 3.02
reconstruct	I - 8.09
record	I - 10.0
recount	II - 1.07

recover	I - 3.06
recruit	III - 2.09
rectify	I - 8.03
reduce	I - 8.04
refer	II - 1.21
refine	I - 8.06
refrain	II - 3.26
refresh	II - 2.11
refund	I - 12.11
refuse	II - 3.27
regain	I - 3.06
register	I - 10.05
regularize	III - 4.09
regulate	III - 4.09
reiterate	II - 1.22
reject	I - 9.05
	II - 3.27
	III - 4.03
relate	II - 1.07
release	I - 12.01
	III - 2.07
relent	II - 3.32
relieve	II - 2.10
remedy	I - 8.03
remind	II - 2.11
remit	I - 12.11
remove	I - 7.16
	I - 9.05
	III - 2.08
renew	I - 8.09
repair	I - 8.03
repeat	II - 1.22
repent	II - 3.04
rephrase	II - 1.12
replace	I - 8.08
	III - 3.08
replenish	I - 8.08
reply	II - 1.02
report	II - 1.07
repossess	I - 3.06
repress	II - 3.26
reprimand	III - 4.01
reproach	III - 4.01
reproduce	I - 10.02
	I - 10.03
reprove	III - 4.01
request	II - 1.23
requisition	I - 3.04
rescind	I - 9.01
reserve	I - 11.04
respect	II - 3.28
respond	II - 1.02
restore	I - 8.09
restrain	II - 3.26
restrict	I - 8.07
	III - 4.05
retain	I - 11.04
retire	II - 3.31
retort	II - 1.02
retrieve	I - 3.06
revamp	I - 8.10
reveal	II - 1.24
revise	I - 5.05
	I - 8.10
revoke	I - 9.01
revere	II - 3.28
rewrite	I - 5.05
reword	I - 5.07
right	I - 8.03
rival	II - 3.12
route	I - 12.12
routinize	III - 2.12
rush	III - 3.03
safeguard	I - 11.03
sanction	III - 4.02
scan	I - 3.07
schedule	III - 2.11
scrap	I - 9.04
scrape	I - 7.18
scratch out	I - 7.04
screen	I - 3.09
	I - 9.06
scrub	I - 7.02
seal	I - 7.19
search	I - 3.08
secure	I - 3.03
seek	I - 3.08
select	I - 3.09
send	I - 12.13
separate	I - 1.04
	I - 7.16
set aside	I - 11.04
settle	I - 13.04
serve	II - 2.02
sharpen	I - 7.20
shelve	I - 11.05
shield	I - 11.03
shine	I - 7.02
shorten	I - 8.04
show	II - 2.07
	II - 2.12
shred	I - 7.03
shun	II - 3.05
shunt	I - 12.15
sign	I - 10.08
sketch	I - 5.02
slight	II - 3.15
socialize	II - 3.29
soften	I - 8.11
solicit	II - 1.03
soothe	II - 2.10
sort	I - 1.04
specify	II - 1.08
splice	I - 7.21
split	I - 7.03
spur	III - 3.06
stamp	I - 7.22
staple	I - 7.05
stimulate	II - 2.04
stock	I - 8.08

	I - 11.05
stop	III - 4.07
store	I - 11.0
streamline	I - 8.10
stress	II - 1.11
stuff	I - 7.23
subdue	II - 3.26
submit	I - 12.14
	II - 3.01
	II - 3.32
subscribe	II - 3.01
substitute	III - 3.08
	III - 4.10
suffer	II - 3.17
suggest	II - 1.25
	III - 4.08
sum	I - 2.18
summarize	I - 5.08
	II - 1.26
supervise	III - 4.11
supplement	I - 8.05
supply	I - 11.05
support	I - 5.03
	II - 2.02
	II - 2.04
surpass	II - 3.18
sway	II - 1.19
sweep	I - 7.02
switch	I - 12.15
systematize	III - 2.12
take dictation	I - 10.08
tape	I - 10.06
teach	II - 2.07
temper	I - 8.11
thank	II - 1.27
thread	I - 7.23
throw away	I - 9.04
tidy	I - 7.02
tolerate	II - 3.17
tone	I - 8.11
total	I - 2.18
touch up	I - 7.07
trace	I - 10.02
train	II - 2.07
transcribe	I - 10.07
transfer	I - 12.15
transform	I - 8.02
translate	I - 6.03
	I - 10.07
transmit	I - 12.0
transpose	I - 8.12
transport	I - 12.03
tutor	II - 2.07
update	I - 8.10
unfold	I - 7.14
unpack	I - 7.15
urge	II - 1.25
	II - 3.10
use up	I - 9.02
utter	II - 1.13
validate	I - 13.05
value	III - 4.04
vary	I - 8.01
venerate	II - 3.28
verbalize	II - 3.30
verify	I - 13.0
veto	III - 4.03
vie	II - 3.12
voice	II - 1.13
void	I - 9.01
warn	II - 2.03
weed	I - 9.06
welcome	II - 2.13
wheedle	II - 3.10
wipe	I - 7.02
withdraw	I - 7.16
	II - 3.31
withstand	II - 3.17
wrap	I - 7.24
write	I - 5.09
	I - 10.08
yield	II - 3.32

APPENDIX D

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